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ABSTRACT

This curriculum guide is designed to assist teachers in junior high and high schools in New Mexico to improve the quality of instruction and to prepare a new curriculum in communications that is consistent with current thinking in industrial arts education. This communications curriculum is designed for one year or 180 hours of instruction, with each of the four sections (telecommunications, visual communications in drafting, graphic communications in printing, and photography) to be implemented on a nine-week basis. Each of the four sections is divided into a course outline and units of instruction. The units of instruction are arranged in the following format: unit description, objectives, content outline, teacher activities, student activities, references/resources, information sheets, transparency masters, teacher demonstration sheets, student assignment sheets, student activity sheets, unit examinations, answers to examinations, and lists of equipment/supplies needed. The objectives found at the beginning of each unit are measured by the student activities or by examinations. Answers are provided for all of the assignments and examinations. A rationale and possible outcomes for the course are also provided in the guide. (KC)

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NEW MEXICO
INDUSTRIAL EDUCATION
CURRICULUM GUIDE

COMMUNICATIONS

Gerald Cunico , Ed.D.

State Department of Education
Division of Vocational-Technical Education
Santa Fe, New Mexico

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PREFACE

The world of communications is a very large system of audio and visual images that are produced and received by the human senses. Each of the various methods of communication are unique in themselves as to what can be transmitted and what can be received. Each involves various and different sources of audio and visual stimulation. The study of communication includes electronics, drafting, photography, printing and design for Industrial Arts. This Curriculum Guide is intended to be used by teachers to aid in the implementation and improvement of an introductory communication curriculum designed to compensate for differences in the teachers previous knowledge and experiences. These materials avoid being descriptive, but do lend themselves to the creative ability of the instructors to change, to expand and to supplement with other contemporary curriculum materials.

Finally, the State of New Mexico is indebted to the State Departments of Education of Tennesse, Georgia, Kansas, Iowa, North Dakota, and the Commonwealth of Virginia which allowed some of the material produced by them to be reprinted herein. Special appreciation is extended to Larry A. Lethem and Richard W. Brothwell, Graduate Assistants at the University of New Mexico, for their efforts in making this Guide a reality.

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Rationale

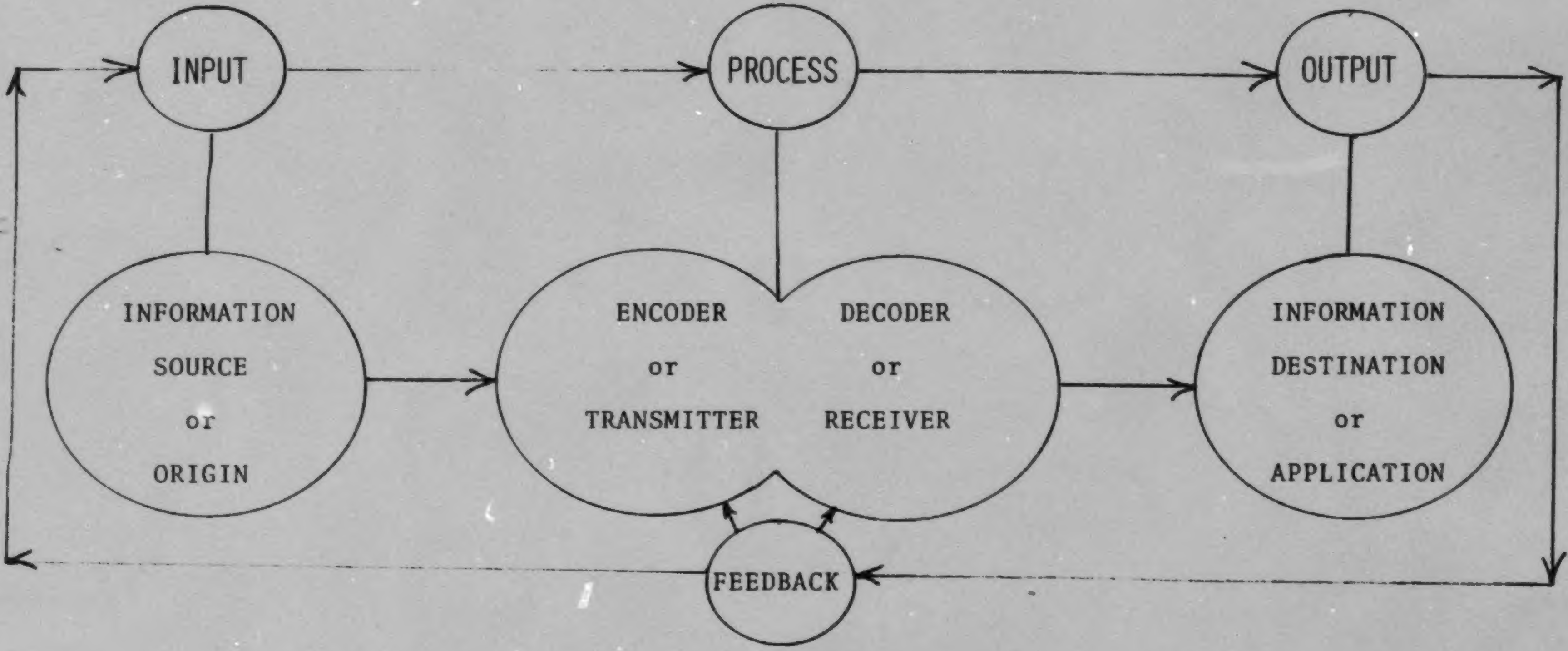
Industrial Arts Education, because of its dependency upon the disposition of industry and technology, has historically been in a constant state of reorientation and transformation. The mission of Industrial Arts Education becomes one of conceiving and designing a program that allows each student to interpret, understand, and make meaningful the basic functions and concepts of industry and technology. Properly conceived, Industrial Arts Education can provide the elements that aid in the discovery and development of the individual through a broad spectrum of experiences and activities with the materials, processes and related problems of our industrial-technological society.

One unique aspect of humanity is the ability to communicate abstract ideas. Beyond the capability to communicate the location of a food source, or the presence of danger, mankind has developed the ability to communicate information regarding the totality of human perception. The more mankind is able to perceive, the more knowledge is accumulated, and the more necessary it becomes for any individual to have an acute understanding of the processes involved in effective communication.

Communications technology is advancing at an incredible rate yet many new techniques are not realizing full potential due to the lack of skilled or interested technicians. Futurists predict that information related fields will be a significant source of employment in the forseeable future. Individuals maturing in the world today have more need to understand the basic principles and processes of communication than ever before in the history of mankind. Success in the adult world today is greatly enhanced by the ability to accurately receive, process and disseminate vast amounts of information in an efficient manner. The longer the educational system delays the provision of comprehensive communications curriculum, the greater will become the gap between the average individual and state of the art communications techniques.

Because of the philosophy of exploration and awareness, Industrial Arts is ideally suited for the presentation of the communications curriculum at the secondary level. Historically, Industrial Arts has dealt with various aspects of communication processes. Graphic communication, specialized vocabulary and specific nomenclature are only a few examples. Now that the need for a more global perspective has become evident, Industrial Arts educators are realizing that they have an excellent base from which to develop a comprehensive approach to communications related education.

Only time will truly evaluate the communications curriculum; however, all present indications suggest its implementation to be a matter of immediate priority.


INPUT
PROCESS
OUTPUT
INFORMATION SOURCE or ORIGIN
ENCODER or TRANSMITTER
DECODER or RECEIVER
INFORMATION DESTINATION or APPLICATION
FEEDBACK

Outcomes

This Curriculum Guide has been written as one of four major curricular clusters intended for use in Industrial Arts at the mid-jr. high school or beginning high school levels. The Guide has been prepared to assist educators in improving the quality of instruction or to assist in preparing a new curriculum in communications that is consistent with current philosophical trends in Industrial Arts.

The study of Communications will provide students with:

learning experiences which assist them in identifying and evaluating their interests, abilities, value judgments and needs as they relate to communications in our society;

introductory and exploratory experiences in communications techniques as a foundation for enrollment in more advanced vocational and technical courses;

an opportunity to develop an understanding of communications careers and to develop those traits which will help students to obtain and maintain employment;

an opportunity to develop problem solving and creative abilities involving the materials, equipment, processes and products of the communications industry;

possible interest and capability in careers related to the total complex of the communications industry.

Curriculum Design Model

There are four major curricular sections in the Communications model. Each section is divided into a course outline and units of instruction. The order in which these sections are presented may be at the discretion of the instructor. The sections can be taught as they are presented or used in conjunction with the instructor's own materials.

This Communications Curriculum Guide has been designed for one year or 180 hours of instruction. Each of the four sections can be implemented on a nine week basis. The units of instruction are divided into the following format:

Unit Description
Objectives
Content Outline
Teacher Activities
Student Activities
References/Resources
Information Sheets
Transparency Masters
Teacher Demonstration Sheets
Student Assignment Sheets
Student Activity Sheets
Unit Exams
Answers to Exams
Equipment/Supplies

The objectives found at the beginning of each unit are measured by the student activities or by examinations. Answers are provided for all of the assignments and exams. The minimum acceptable performance level for all assignments and exams is to be determined by the instructor.

COMMUNICATIONS COURSE OUTLINE

- I. INTRODUCTION
  - A. Communication Models
  - B. Communication Systems
    - 1. Person to Person
    - 2. Human to Machine
    - 3. Machine to Machine
- II. TELECOMMUNICATIONS
  - A. Relationship to Communication Model
  - B. Process
    - 1. Power Supply
    - 2. Amplification
    - 3. Oscillators
    - 4. Switching
  - C. Study of One-Way Communication Systems
    - 1. Radio
    - 2. Phonograph
    - 3. Television
    - 4. Tape Recording
  - D. Study of Two-Way Communication Systems
    - 1. Telegraph
    - 2. Telephone
    - 3. Radar
    - 4. Satellites
    - 5. Computer
    - 6. Tape Recording
  - E. Telecommunication Careers
    - 1. Community Resources
    - 2. Community Telecommunications Industries
- III. VISUAL COMMUNICATIONS (DRAFTING)
  - A. Types of Drawings and How They Are Used
    - 1. Orthographic
      - a. Shape Description
      - b. Size Description

2. Pictorial
    a. Design
    b. Function
3. Schematic
    a. Direction
    b. Position
4. Industrial Design
    a. Creation
    b. Materials
5. Electronic
6. Architectural
7. Civil

B. How Drawings Become Reality

1. The Use of Drawings
    a. Describe Parts
    b. Show Assemblies
    c. Describe Systems
    d. Control Limits
2. Uses of Drawings
    a. Organization of an Operation
    b. Directions to Builder on the Construction of a Part
    c. Demonstration of Parts Assembly
    d. Description of Relationships Between Systems
3. Uses of Drawings in Industry
    a. During Planning Stages Before Inception of an Operation
    b. During Assembly
    c. During On-Site Construction
    d. During Manufacturing in Plant

C. Starting to Draw

1. Sketching
    a. Straight Lines
    b. Circles
    c. Ovals
    d. Curves

    2. Alphabet of Lines
    3. Lettering

D. Measuring
    1. Development of Measures
    2. Precision Measurement
    3. How to Measure
    4. Measuring Angles
    5. Measuring Systems

E. Dimensioning
    1. Purpose
    2. Dimension and Extension Lines
    3. Size and Location Dimension
    4. Dimensioning Techniques

F. The Tools of the Draftsman
    1. Types of Tools
    2. Symbols Used in Drawing
    3. Care and Use of Drafting Tools

G. Drawing Mechanically
    1. Orthographic Projection
    2. Working Drawings

H. Drawing to Scale
    1. Why Scales Are Used
    2. Types of Scales

I. Types of Pictorial Drawings
    1. Oblique
    2. Isometric

J. Other Type Drawings
    1. Schematic

    - 2. Architectual
    - 3. Design
- K. Drafting Careers
    - 1. Community Resources
    - 2. Community Industries Using Drafting

IV. GRAPHIC COMMUNICATIONS

- A. Relationship to Communications Model
- B. Layout and Design
    - 1. Design Principles
    - 2. Typography
    - 3. Job Planning and Layout
- C. Image Generation
    - 1. Historical
        - a. Cave Painting
        - b. Pictograms
        - c. Hieroglyphics
        - d. Alphabet Development
    - 2. Hot Composition
        - a. Hand Set Foundry Type
        - b. Machine Set Foundry Type
    - 3. Cold Composition
        - a. Clip Art
        - b. Strike-On Image
        - c. Photo-Composition
        - d. Freehand Composition
- D. Photo-Conversion: Principles of Process Photography
    - 1. Basic Functions of the Camera
    - 2. Camera Types and Applications
    - 3. Elements of the Theory of Light
    - 4. Types and Applications of Film
    - 5. Procedure for Exposing and Processing Line Negatives

    6. Procedure for Exposing and Developing Halftone Negatives

E. Image Carrier Preparation

    1. Letterpress-Type Setting
    2. Flexography-Rubber Stamp Making
    3. Gravure-Plate Preparation
    4. Offset-Plate Making
    5. Electrostatic-Master Preparation
    6. Screen Printing Stencil Preparation
    7. Mimeograph-Stencil Preparation
    8. Spirit Duplicator-Master Preparation

F. Image Transfer

    1. Letterpress
    2. Gravure
    3. Offset
    4. Electrostatic
    5. Screen Printing
    6. Mimeograph
    7. Spirit Duplicator
    8. Paper and Ink Selection

G. Binding, Finishing and Packaging

    1. Binding
        a. Padding
        b. Stapling
        c. Loose Sheet
    2. Finishing
        a. Cutting and Trimming
        b. Folding
        c. Drilling and Punching
        d. Collating and Gathering
        e. Laminating

    3. Packaging

H. Graphic Communications Resources

    1. Community Resources
    2. Community Graphic Communications Industries

V. CONTINUOUS TONE PHOTOGRAPHY

A. Relationship of Photography to Communications Model

B. Black and White Still Photography

    1. Camera Types
    2. Camera Parts
    3. Camera Handling and Operation
    4. Photo-Composition
    5. Film and Film Processing
    6. Printing and Enlarging
    7. Finishing, Mounting and Display

C. Cinematography

    1. Camera Types
    2. Camera Handling and Operation
    3. Planning and Composition
    4. Film and Film Processing
    5. Editing and Splicing
    6. Projection Techniques

D. Photography Careers

    1. Community Resources
    2. Community Industries Using Photography

INTRODUCTION TO COMMUNICATIONS TECHNOLOGY

GENERAL OBJECTIVE:

Upon completion of this unit, the student will demonstrate knowledge of the history and impact of communications technology. The student will also demonstrate the ability to define basic nomenclature associated with communications processes.

SPECIFIC OBJECTIVES:

Upon completion of this unit, students will be able to

1. match events in the history of communications technology with the date of the process development;

2. match nomenclature with the correct definitions or descriptions;

3. identify and define the five elements of the basic communications model; and

4. compare and contrast the communications processes of telecommunication, drafting communication, and graphic communication.

CONTENT OUTLINE

1. Overview and define terms used in the general communications model.

2. Define and discuss the various communications processes.

    A. Telecommunications

        1. radio
        2. telegraph
        3. telephone
        4. television
        5. radar
        6. satellite
        7. computers

    B. Drafting Communication

        1. techniques
        2. types of mechanical drawings

    C. Graphic Communication

        1. graphic techniques

3. Overview of the historical background of the various communications techniques.

    A. Development of Electric and Electronic Communications Systems

    B. Development of Mechanical Drawing

    C. Development of Printing

    D. Development of Photography

4. Overview basic communications model and demonstrate the relationship to all forms of communications.

TEACHER ACTIVITIES:

1. Prepare necessary transparencies and handout material.

2. Provide specific definitions for nomenclature used.

3. Present introductory information for the areas of telecommunication, drafting communication, and graphic communication.

4. Present historical background of communications processes.

5. Present basic communications model and show the relationship to various methods of communications.

STUDENT ACTIVITIES:

1. Students discuss the ways that advanced communications systems have improved human lifestyles.

2. Students relate various communication methods to the general communications model.

3. Student groups discuss methods of communication between man and machine.

TELECOMMUNICATIONS

TELECOMMUNICATIONS PROCESSES

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the function and application of the following processes:

- A. Power Supply
- B. Amplification
- C. Oscillators
- D. Switching

CONTENT OUTLINE

1. Power Supply

    A. Transformers
        1. step-up, step-down voltage
        2. isolation
        3. 180 phase shift

    B. Rectifiers
        1. operation theory
        2. types

    C. Filters
        1. operation theory
        2. types

    D. Voltage Regulators
        1. theory
        2. types

3. Oscillators

    A. Basic Principles of Operation

4. Switching

    A. Basic Principles
        1. and gate
        2. or gate
        3. nand gate
        4. nor gate

TEACHER ACTIVITIES

1. Make transparencies.

2. Present information relative to content outline.

3. Attend classroom discussions covering the function and application of each process.

4. Demonstrate the operation of the basic components of power supplies and amplification systems.

STUDENT ACTIVITIES

1. Participate in lecture discussion on the function and application of power supply.

2. Breadboard a power supply.

    A. Test power supply for proper operation.

3. Produce a black diagram of a basic amplifier.

    A. Discuss the operation of amplifiers.

    B. Breadboard an amplifier.

    C. Connect amplifier to power supply and test for proper operation.

4. Discuss the basic principles of oscillators.

    A. Breadboard an oscillator.

    B. Connect the oscillator to the existing power supply and amplifier.

    C. Test the oscillator for proper operation.

5. Participate in lecture discussion on the principles of switching.

ONE WAY COMMUNICATION SYSTEMS

GENERAL OBJECTIVE:

Upon completion of this unit, the student will be able to recognize communication systems that do not involve the use of feedback and to demonstrate knowledge of the basic operating principles behind such systems.

SPECIFIC OBJECTIVES:

A. Radio

1. Demonstrate knowledge of transmitter operation.

2. Produce a diagram of wave propagation.

3. Identify the functions of antennas.

4. Explain the basic difference between crystal receivers and hetrodyne receivers.

B. Phonograph

1. Explain how a recording is produced.

2. Describe the basic operating principles of a phonograph.

3. Explain the function of an amplifier.

4. Identify the components of the speaker system and describe the function of each component.

C. Television

1. Explain the basic principles of television operation.

2. Describe the conversion of light and sound to electrical images in a television camera.

3. Diagram the basic circuitry of a television receiver.

4. Compare the video components of a black and white television to the video components of a color television.

D. Tape Recording

1. Describe the process of recording information on tape.

2. Compare the major advantages of a tape recording to the major advantages of a phonograph.

3. Identify the major components of a tape recorder.

4. Describe the difference between one channel and stereo tape recording equipment.

TEACHER ACTIVITIES:

A. Radio

1. Diagram and explain the operation of a basic radio transmitter.

2. Diagram and discuss radio wave propagation.

3. Discuss the purpose and function of antennas.

4. Compare the basic operation of a crystal radio receiverto that of a hetrodyne receiver.

B. Phonograph

1. Explain the discuss the procedure for producing a recording.

2. Demonstrate and explain the operation of a phonograph.

3. Diagram and explain a phonograph speaker system.

C. Television

1. Develop diagrams on overhead transparency to illustrate the basic principles of television operation.

2. Explain and discuss the basic principles of television operation.

3. Diagram and discuss the operation of a television camera.

4. Demonstrate the operation of a television camera.

5. Compare and discuss the video components of both black and white and color television receivers.

D. Tape Recording

1. Explain the conversion of sound into electrical signals.

2. Demonstrate the operation, care and basic maintenance of a tape recorder.

Two-Way Communication Systems

General Objective:

Upon completion of this unit, the student will be able to recognize two-way communication systems and to demonstrate knowledge of the basic operating principles of such systems.

TELEGRAPH

Specific Objectives:

This unit will cover the basic concepts of the telegraph. It will present an overview of the following: how the telegraph functions and the uses of the telegraph as a communication system.

Unit Objectives:

After completion of this unit the student will be able to identify terms and definitions, describe how the early telegraph functioned, describe how today's teletypewriter functions and list and describe uses of today's telegraph system as a communications system.

Performance Objectives:

After completion of this unit the student will be able to:

1. Match given terms to the correct definitions and descriptions.

2. Describe how the early telegraph functioned.

3. Describe how today's teletypewriter system functions.

4. List and describe 5 uses of today's telegraph system as a communications system.

CONTENT OUTLINE

I. How it functions

A. Early system: The telegraph was the first fast means of long distance communication. The actual telegraph was a very simple device consisting of a key, sounder and a power source.

1. Key: This was simply a spring loaded normally open switch. When the key was depressed, current flowed through the system.

2. Sounder: This consisted of an electromagnet with a metal bar positioned above it. When current flowed through the electromagnet the bar was pulled down causing an audible click. When current flow ceased the bar was released also causing an audible click.

3. Power source: The primary power source was a chemical cell battery.

4. Morse Code: Named after the American inventory of the telegraph this is a code where each letter of the alphabet is coded with dots and dashes. A dot was represented by about 1/4 of a second between clicks on the sounder and the dash was about three times that.

B. Today's System: The simple telegraph of the early days has been replaced by a much more sophisticated piece of equipment, the teletypewriter. Teletypewriters are capable of sending and receiving between 65 and 100 words per minute.

1. Information Source: There are two sources of information for a teletypewriter. One is the keyboard which resembles a standard typewriter and the other is a paper tape coded with punched holes.

2. Encoder or transmitter: In the base of a teletypewriter is a device that constructs and transmits an electronically coded signal. The coded signal is made up of electronic pulses. This device is activated by either the keyboard or a punched tape.

3. Message channels: The primary message channels used by a telegraph company are coaxial cable and microwave transmission lines that are leased from a telephone system.

4. Decoder or receiver: Also located in the base of the teletypewriter is a device which receives and decodes the coded signal.

5. Information destination: As the coded signal is decoded, the keyboard, which is the final destination of the signal, is activated and typed copy results.

Terms and Definitions:

1. Key: Hand-operated switch used to open and close a circuit.

2. Morse code: A code system of dot-and-dash signals developed by Samuel F. B. Morse.

3. Sounder: A telegraph receiving instrument consisting of an electromagnet and a moving armature.

4. Telegraph: A system that employs interruptions or polarity changes of direct current for the transmission of coded signals.

5. Teletypewriter: A telegraph instrument with a signal activated device for automatically typing received messages and a keyboard for sending messages.

Demonstrations:

Using a simple buzzer circuit, demonstrate how a simple telegrph system functions using Morse code.

Materials:

1 - buzzer (doorbell type)

1 - transformer (for buzzer)

1 - telegraph code key

Procedure:

1. Construct a simple series circuit with the switch buzzer and source.

2. Prepare a short simple coded message using Morse Code.

3. Tap out the message to the class using the buzzer circuit (make sure to leave a time gap between letters).

Telephone

Specific Objectives:

This unit will cover the basic concepts of the telephone. It will give an overview of the following areas: how the telephone functions, the Bell system, uses of the telphone, and uses of the telephone system telecommunications network.

Unit Objectives:

After completion of this unit the student will be able to identify terms and definitions, describe how the telephone functions, describe the Bell system, list and describe uses of the telephone, list and describe uses of the Bell system telecommunications network.

Performance Objectives:

After completion of this unit the student will be able to:

1. Match given terms to definitions and descriptions

2. Describe how the telephone functions

3. Describe the telephone system

4. List and describe 2 uses of the telephone

5. List and describe 4 uses of the telephone system telecommunications network.

CONTENT OUTLINE

I. How it functions

A. Central terminal: The nerve center of the telephone network. This is where all of switching equipment and radio transmission is located. All calls are routed through a central office. There may be one or many central offices in a city. It depends on the number of phones.

B. Information source: In the modern telephone the information source is a carbon microphone inside the mouthpiece of the handheld unit. This microphone changes the sound waves produced by the voice into an electrical audio signal. This signal goes over wire to a central office.

C. Encoder or transmitter: When the electrical signal reaches the central terminal one of two things happens. If the call is a local call to a phone number originating in the same terminal then the simple audio signal is amplified and sent to the receiving phone. If it is a local call that has to go through another terminal or if it is a long distance call the audio is modulated onto an RF carrier wave in a radio transmitter and transmitted via a microwave network.

D. Message Channel: There are three primary channels now used in the transmission of signals in the telephone system and some experimental channels.

1. Primary Channels

a. Open wire: This consists of a pair (or several pairs together in a cable) of insulated copper conductors. It takes one pair for a complete circuit used for voice only.

b. Coaxial cable: This is a special type of cable that is shielded against outside interference from radio waves. Using coaxial cable allows many calls to be "multiplexed" onto carrier waves and transmitted all on one cable at the same time. Coaxial can carry radio or TV signals as well as voice.

c. Microwave: Using high frequency radio waves (microwaves), phone calls can be modulated and multiplexed onto these high carrier frequencies and transmitted along a series of relay towers from city to city. Microwaves can also be bounced off of satellites to span the globe. Microwave can also carry radio or TV signals as well as voice.

2. Experimental Channels

a. Laser: This is a special highly concentrated beam of coherent light. It may be able to be used in place of radio waves as a communications medium.

b. Fiber optics: These are a special type of long thin flexible glass fibers which are being developed to use as a conduit for laser communications.

E. Decoder or Receiver: When a phone call that has been modulated onto a carrier wave reaches the last central office on its path to its destination phone, the audio signal is retrieved from the carrier wave and then sent toward its final destination.

F. Information Destination: The earpiece of a telephone is the final destination and is actually a small speaker that changes the audio signal into sound waves that can be heard by the human ear.

G. Dial Circuit: There are two types of dial circuits in today's phones. These are the rotary and the touchtone.

1. Rotary: This is the method whereby a person rotates a numbered dial on the phone. Each number, when dialed, causes a corresponding number of clicks. These clicks are counted by special equipment at the central office and switches are opened and closed to route the call on its proper path.

2. Touchtone: Instead of dialing numbers with this sytem a person just touches the numbers in sequence. Each number, when pushed, emits a certain tone (frequency of sound) and equipment at the central office "hears" the different tones and this begins the switching procedure to route the call properly.

II. The Bell Telephone System

A. The Business: The Bell System is made up of 26 different corporatins, each of which perform a separate task and all of which, working closely together, form the largest telecommunications system in the world.

B. Telecommunications Network: The Bell System network is the heart of the communications industry in the United States. Most private homes have a phone and almost without exception, businesses and industries use this vast network in one or more ways. It is composed of hundreds of thousands of miles of wire, cable, microwave relay networks, and satellites. These all work together for the largest, fastest, and most used communications network in the world.

C. Bell Laboratories: One of the 26 corporations, this is the research arm of the Bell System. Scientists here are responsible for developing and designing new devices and techniques for improved communications systems. One of the most notable accomplishments of Bell Labs was the invention of the transistor in 1948.

III. Uses of the Telephone

A. Personal: The personal telephone is used for everything from idle chit chit to summoning the police or fire department in an emergency (includes local and long distance).

B. Business: The business phone provides quick and economical communication between businesses, and between people within a business.

IV. Uses of the Bell System Telecommunications Network

A. Private: All private phone calls go through the network.

B. Business and Industrial: Along with their phones, many businesses lease cable or satellite time from the Bell System. Some examples are:

1. Western Union leases most of its cable from the Bell System.

2. Radio and TV networks use the Bell System to route network programming from their main studios to their affiliate stations all across the country.

3. Many data communications companies lease cable or satellite time from the Bell System.

C. Government: The government leases cable from the Bell System for a lot of its communication needs. Three examples are:

1. Military: Much of the high level and top secret military communications systems use cable leased from the Bell System.

2. Air traffic control centers across the country are tied together through the Bell network and their phone bill is over $1,000,000 per month.

3. Direct lines: Many government agencies have direct phone lines to other agencies for special use. An example would be the red phone in the White House that connects Washington and Moscow, USSR.

Demonstrations:

Objective:

To show the students the different parts of the interior of a telephone.

Materials:

1 - telephone (dial type) (Borrow from Bell Telephone)

1 - telephone (touchtone type) (Borrow from Bell Telephone)

Procedure:

1. Show both phones and explain the difference between the dial and touch-tone systems.

2. Disassemble the mouthpiece of each phone and show the microphone.

3. Disassemble the earpiece of each phone and show the speaker.

4. Take the cover off of each phone and point out the dial circuitry and the touch-tone circuitry.

5. Point out the bells that ring.

6. Point out and discuss any other items of interest within the phone.

RADAR

Specific Objectives:

This unit will explain the basic concepts of Radar. It will present an overview of the basic Radar system, its functions and its uses as a communication system.

Unit Objectives:

After completion of this unit the student will be able to identify terms and definitions and describe how a Radar system functions.

CONTENT OUTLINE

I. How it functions

Radar (an acronym for radio detection and ranging) an electronic system in which the transmission and return of an electromagnet impulse is used to determine the direction and range (distance) of an object.

Radar had its beginning with Heinrich Hertz, a German scientist, who observed that an electromagnet wave (radio) could be reflected from solid objects.

The operating principle of Radar is similar to when you hear an echo of your own voice. What occurs when you hear an echo is that the sound waves travel through the air and strike an object at some distance from you and are reflected or bounced back toward you, enabling you to hear them for a second time. The time that it takes for the echo to return depends upon the distance of the object.

In the Radar system the same principle can be utilized. Range (distance), azimuth (direction) and elevation (height) can be determined by the use of a directional device to transmit, receive and measure the time it takes for the electromagnetic wave to return. In modern, sophisticated systems range, direction and elevation, along with other pertinent data such as size and speed can be determined at the same time.

Satellites

Specific Objectives:

This unit will cover the basic concepts of satellite communication systems. It will present an overview of how satellites function and the uses of satellites as communication systems.

Unit Objectives:

After completion of this unit the student will be able to identify terms and definitions, describe how satellites function, and uses of satellites today.

Content Outline

I. Historical Perspective

A. Sputnik

B. United States Committee to Land a man on the moon before 1970

C. Creation of National Aeronautic and Space Administration (NASA) in 1958; by 1965 NASA's annual appropriation had reached $5.2 billion

II. Space - vehicle electronics

A. Basic requirements: reliable, low voltage, high current

B. Development of solar cell to recharge space vehicles' batteries

C. Two-way and one-way communications

III. Synchronous and orbital satellites

A. Synchronous satellites are operated in synchronism with the earth's rotational orbit. Both rotate at the same speed, consequently the satellite is always in the same position relative to the earth.

B. Orbital satellites are operated in their own orbits above the earth, consequently constantly changing their relative position with the earth.

IV. Satellites and their uses

A. Weather Data

B. Television and radio communication relay stations allowing these signals to be broadcast over veryllong distances

C. Telephone relay

D. Military applications

Terms and Definitions:

1. NASA

2. Synchronous satellites

3. Orbital satellites

4. Two-way communications

5. One-way communications
6. Solar cell
7. Special electronics for satellites

Computers (microprocessors)

Specific Objectives:

This unit will cover the basic concepts of computer systems. It will present an overview of the computer's historical development and how computers function.

Unit Objectives:

After completion of this unit the student will be able to identify terms and definitions, describe how computers function and uses of today's computers and microprocessors.

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Content Outline

I. Historical Perspective

From the time that man began to use a system of counting, he has sought ways to aid or speed up his ability to calculate or handle numbers. One of the earliest and one that is still used today is the abacus. The abacus was probably the first true calculating machine developed in the far east, probably in China at about 4000 to 3000 B.C. It is a relatively simple device consisting of a wooden frame and a number of parallel taut wires supporting a series of colored beads which are free to move along the wires. Within a few centuries it had spread as far west as the Roman Empire where it was used by most of the merchants and shop owners for all of their business calculations. The Romans called the beads "calculi" meaning pebble, giving rise to our word "calculate" and the mathematical area of study known as "calculus." Even today the abacus is widely used in some oriental countries, which allows a skilled operator to add, subtract, multiply and divide with amazing speed and accuracy. Calculating machines such as desk calculators, cash registers and adding machines had their beginning with the invention of a mechanical calculator in the seventeenth century by Blaise Pascal. His machine was the first to introduce the concept of "carry" by utilizing a series of dials numbered from 0 to 9 arranged so that when one of the dials pressed from 9 to 0 a lever caused the dial next to it to move one unit forward. Hence its ability to add and subtract.

The speed and accuracy of such machines that are used to solve arithmetical calculations is limited by one main aspect: they must all be manually operated step-by-step. A solution to this dilemma was proposed by Charles Babbage, who in 1833 designed a machine that was capable of eliminating the operator by mechanizing the entire process. Babbage's machine used cards with holes punched in them that programmed both instructin and the data into the machine. Although the machine was never completed it did establish the basic principles upon which modern computers are based.

Modern Computers

All computers fall into two broad categories: analog and digital. Analog computers are designed to deal with two or more variables, such as distance and time (speed), pressure and temperature, etc. Analog computers are very useful in matching one variable to another.

A digital computer is an electronic device that can receive, change, manipulate, store and transmit electronic impulses. This is accomplished by a series of electrical instructions called a program. Some examples of digital applications are the pocket calculator, the digital wristwatch, a digital speedometer in an automobile, and of course the very popular microcomputer and video games that have blossomed during the last decade.

II. Digital Principles

   A. Binary numbering system
   B. Principles of Logic Gates and Flip-flops
   C. Programming
   D. Computer languages

Terms and Definitions:

1. Microprocessors
2. Analog computers
3. Digital computers
4. Binary
5. Logic gates
6. Flip-flops
7. Programming
8. Computer languages

DRAFTING COMMUNICATIONS

TYPES OF DRAWING AND THEIR USE

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of different types of drawings and how each type of drawing is used.

CONTENT OUTLINE:

1. Orthographic
    - A. Object shape
    - B. Objecti size
    - C. Views
2. Pictorial
    - A. Isometric
    - B. Oblique
    - C. One, two point perspectives
3. Schematic
    - A. Electrical
    - B. Plumbing
    - C. Heating/Cooling
4. Industrial Design
    - A. Assembly Drawings
5. Electronic
    - A. Schematic
    - B. Block Diagram
    - C. Symbols
6. Architectural
    - A. Plot plan
    - B. Floor plan
    - C. Elevations

42

7. Civil

   A. Roads

   B. Dams

   C. Bridges

   D. Maps

TEACHER ACTIVITIES:

1. Make transparencies.

2. Obtain examples of different types of drawings.

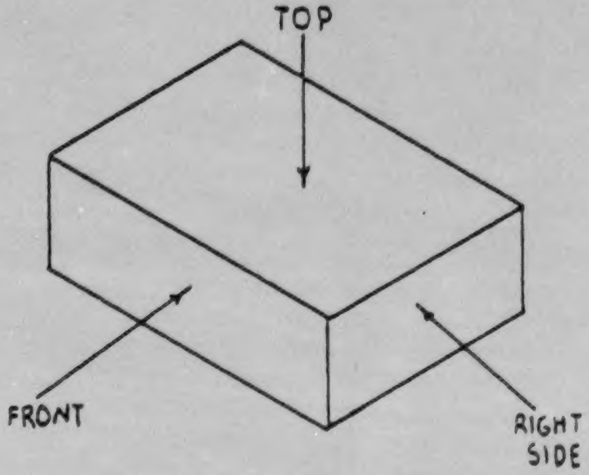
3. Present information relative to content outline.

4. Attend classroom discussions relative to types of drawing found throughout industry.

STUDENT ACTIVITIES:

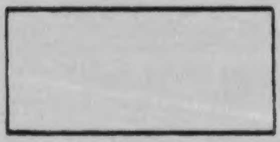
1. Participate in lecture discussion on the types of drawings and their associated industrial use.

2. Develop a listing of community industries and the types of drawings these industries would use.


TOP
FRONT
RIGHT SIDE

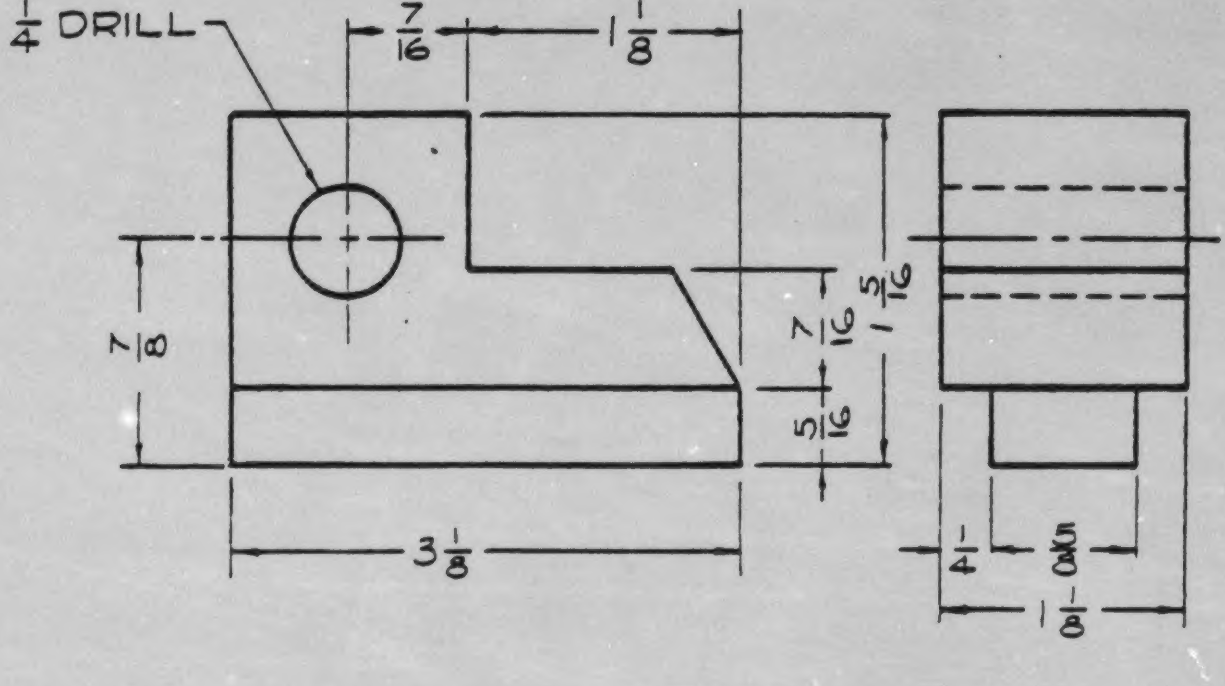
TOP VIEW

FRONT VIEW



RIGHT SIDE VIEW

Size and Shape Description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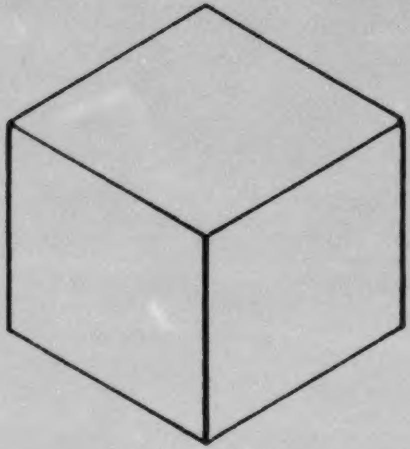
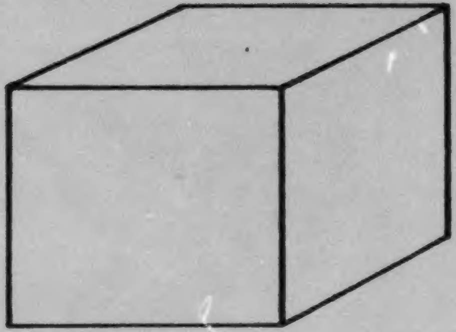
7/16
1 1/8
7/8
7/16
1 5/16
5/16
3 1/8
1/4
5/8
1 1/8

Types of Pictorials

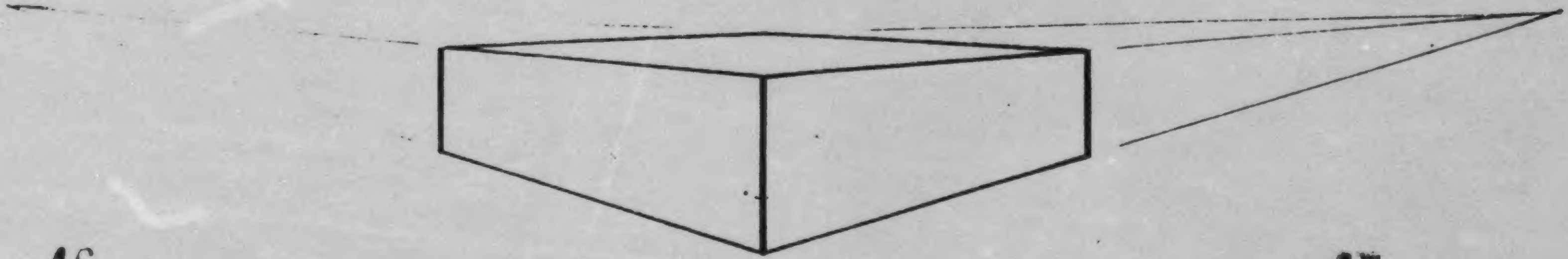


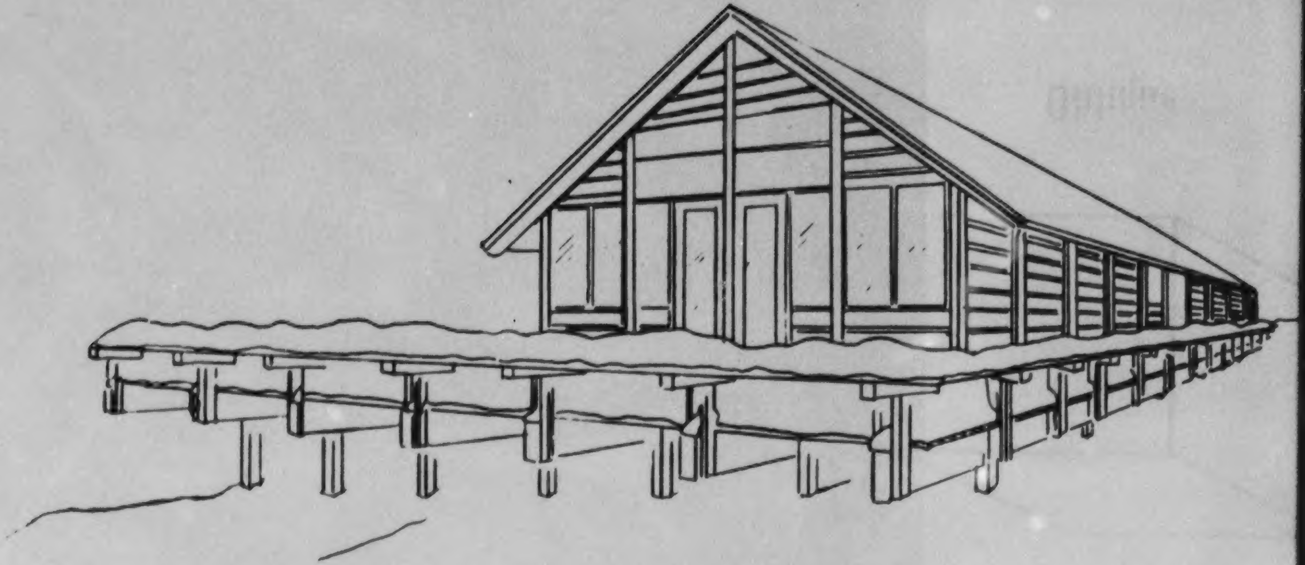
Isometric

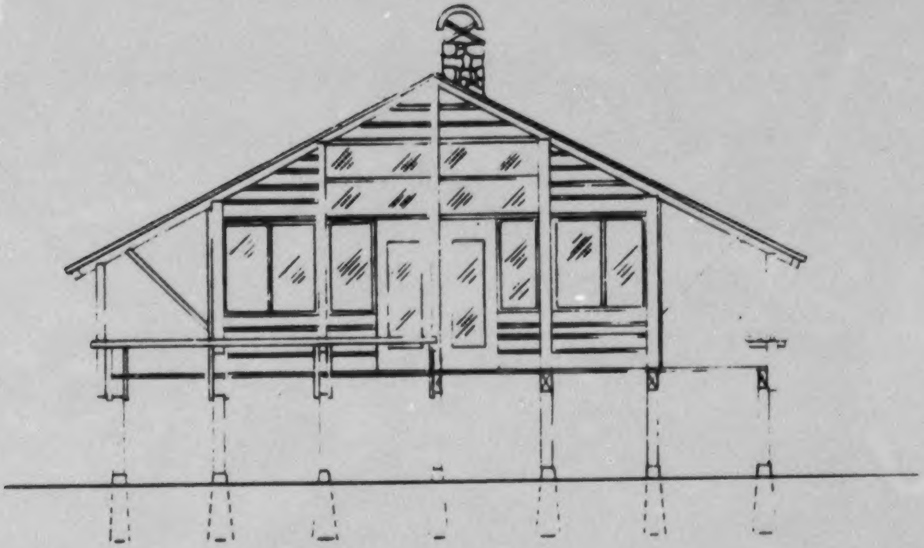


Oblique

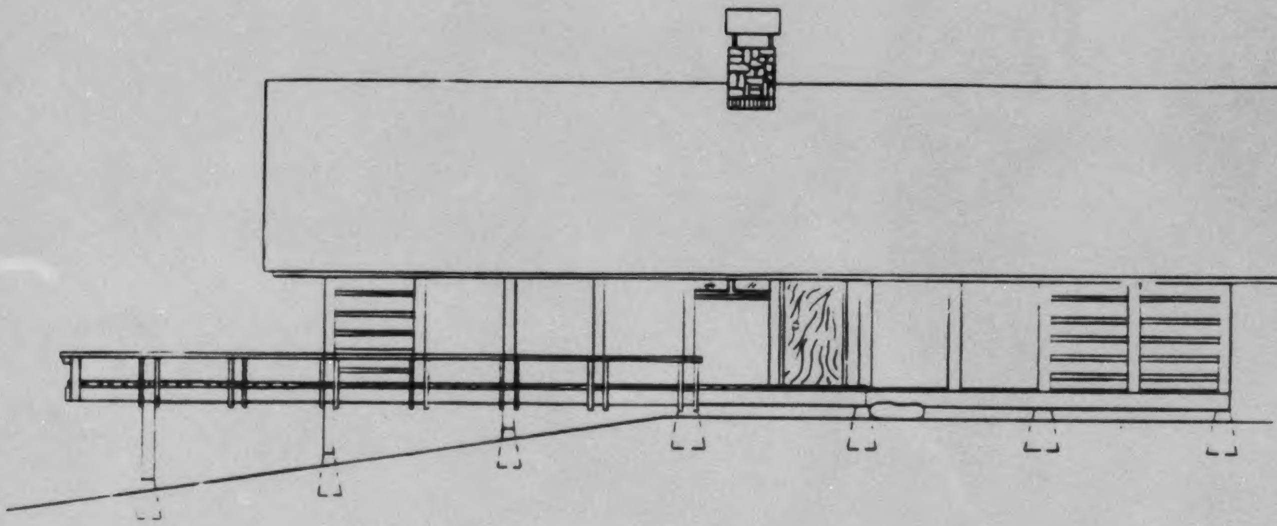
Perspective



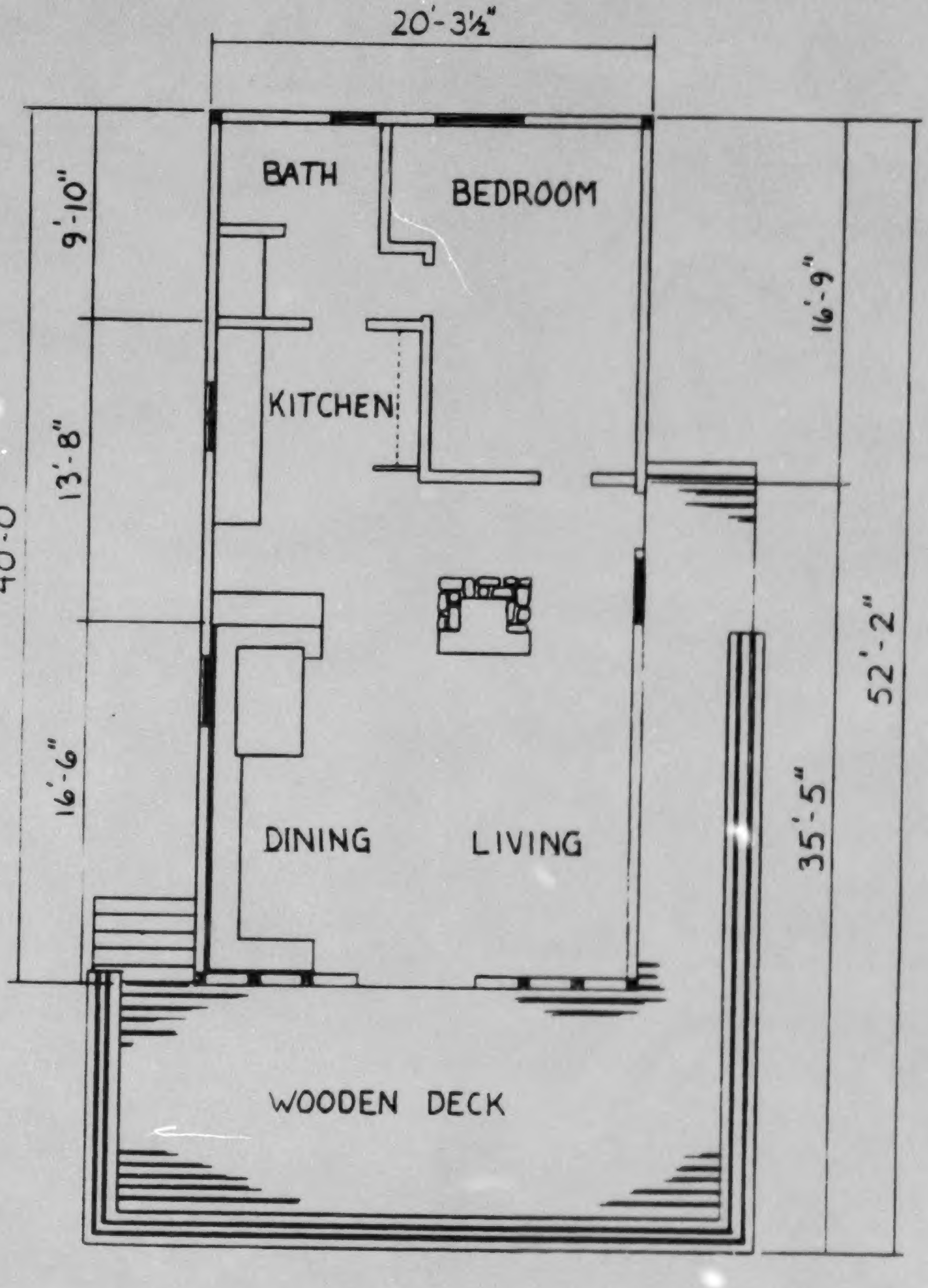




FRONT ELEVATION
SCALE: $\frac{1}{8}$" = 1'-0"

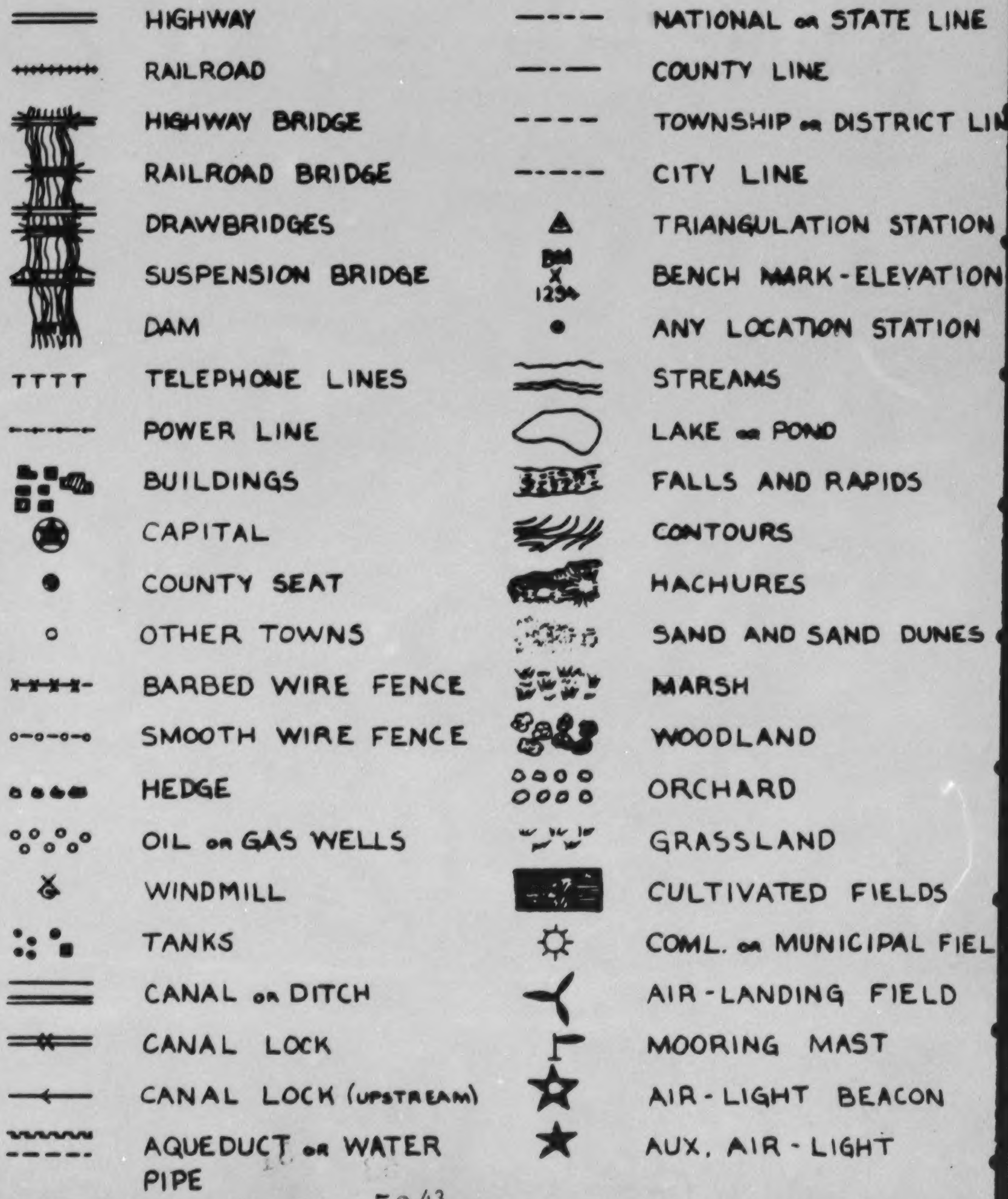


RIGHT SIDE ELEVATION
SCALE: 1/8" = 1'-0"


20'-3½"
BATH
BEDROOM
9'-10"
16'-9"
KITCHEN
13'-8"
40'-0"
52'-2"
16'-6"
35'-5"
DINING
LIVING
WOODEN DECK

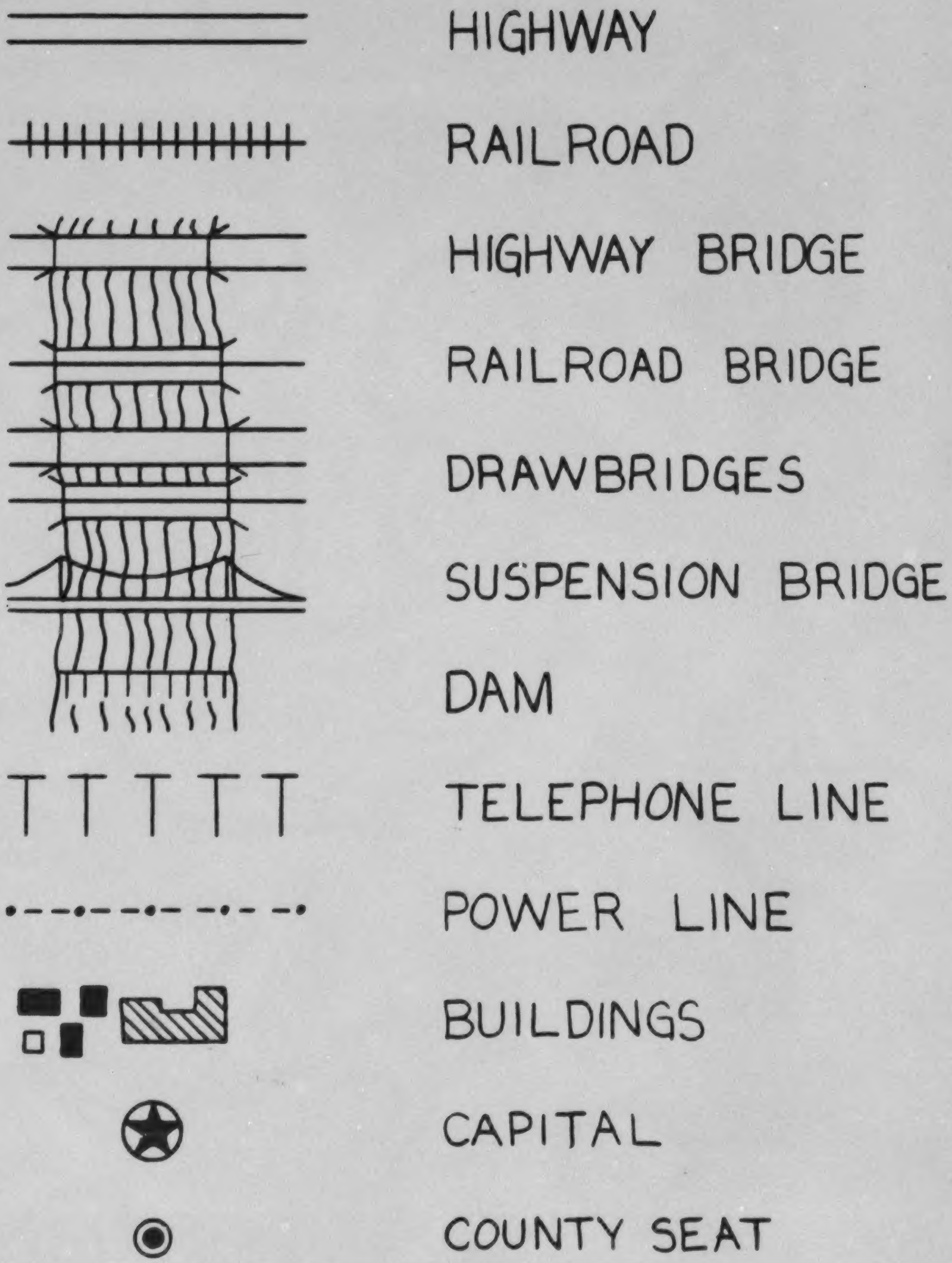
FLOOR PLAN
SCALE: ⅛"=1'-0"

TOPOGRAPHIC SYMBOLS



HIGHWAY
RAILROAD
HIGHWAY BRIDGE
RAILROAD BRIDGE
DRAWBRIDGES
SUSPENSION BRIDGE
DAM
TELEPHONE LINES
POWER LINE
BUILDINGS
CAPITAL
COUNTY SEAT
OTHER TOWNS
BARBED WIRE FENCE
SMOOTH WIRE FENCE
HEDGE
OIL OR GAS WELLS
WINDMILL
TANKS
CANAL OR DITCH
CANAL LOCK
CANAL LOCK (UPSTREAM)
AQUEDUCT OR WATER PIPE

NATIONAL OR STATE LINE
COUNTY LINE
TOWNSHIP OR DISTRICT LI
CITY LINE
TRIANGULATION STATION
BENCH MARK-ELEVATION
ANY LOCATION STATION
STREAMS
LAKE OR POND
FALLS AND RAPIDS
CONTOURS
HACHURES
SAND AND SAND DUNES
MARSH
WOODLAND
ORCHARD
GRASSLAND
CULTIVATED FIELDS
COML. OR MUNICIPAL FIEL
AIR-LANDING FIELD
MOORING MAST
AIR-LIGHT BEACON
AUX. AIR-LIGHT


HIGHWAY
RAILROAD
HIGHWAY BRIDGE
RAILROAD BRIDGE
DRAWBRIDGES
SUSPENSION BRIDGE
DAM
TELEPHONE LINE
POWER LINE
BUILDINGS
CAPITAL
COUNTY SEAT

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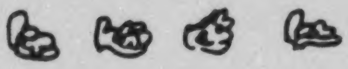
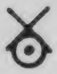
o—o—o—o—o	SMOOTH WIRE FENCE
	HEDGE
○ ○ ○ ○ ○ ○ ○	OIL WELLS
	WINDMILL
● ● ● ● ● ⊘ ▨	TANKS
═══	CANAL OR DITCH
═<<═	CANAL LOCK
—<—	CANAL LOCK (UPSTREAM)
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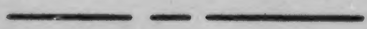
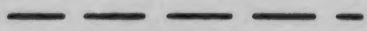
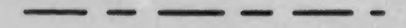
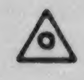
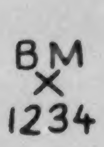
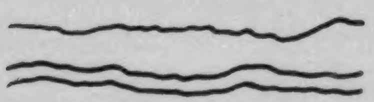
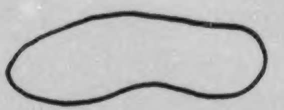
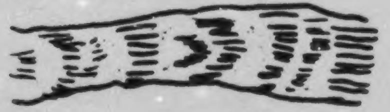
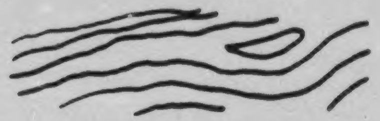
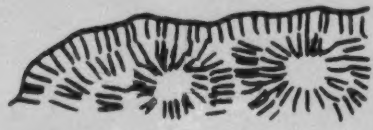
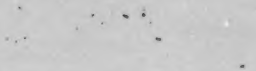
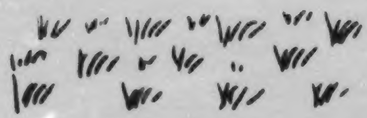
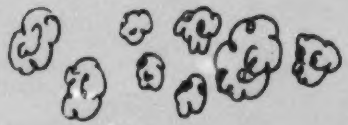
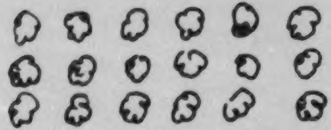
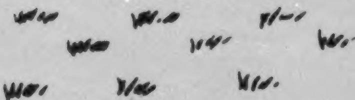
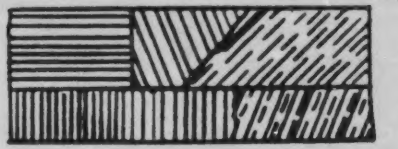
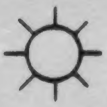
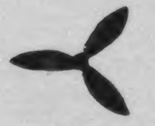
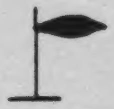
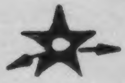
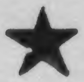
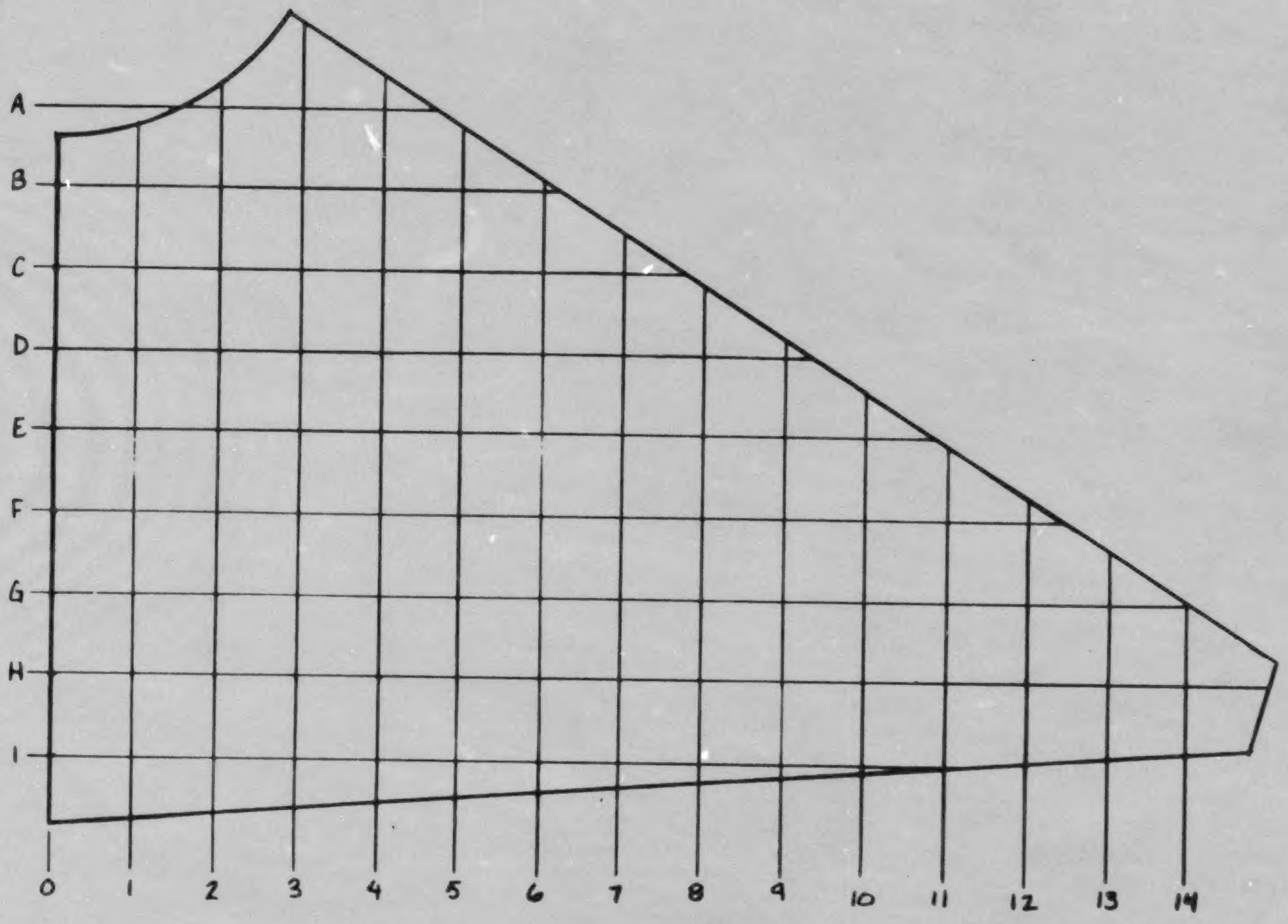
— – – —	STATE LINE

	COUNTY LINE
	DISTRICT LINE
	CITY LINE
	TRIANGULATION STA.
	BENCH MARK AND ELEV.
	ANY LOCATION STA.
	STREAMS
	LAKE OR POND
	FALLS AND RAPIDS
	CONTOURS
	HACHURES

	SAND AND SAND DUNES
	MARSH
	WOODLAND
	ORCHARD
	GRASSLAND
	CULTIVATED FIELDS
	COML. OR MUN. FIELD
	AIR LANDING FIELD
	MOORING MAST
	AIR LIGHT BEACON
	AUX. AIR-LIGHT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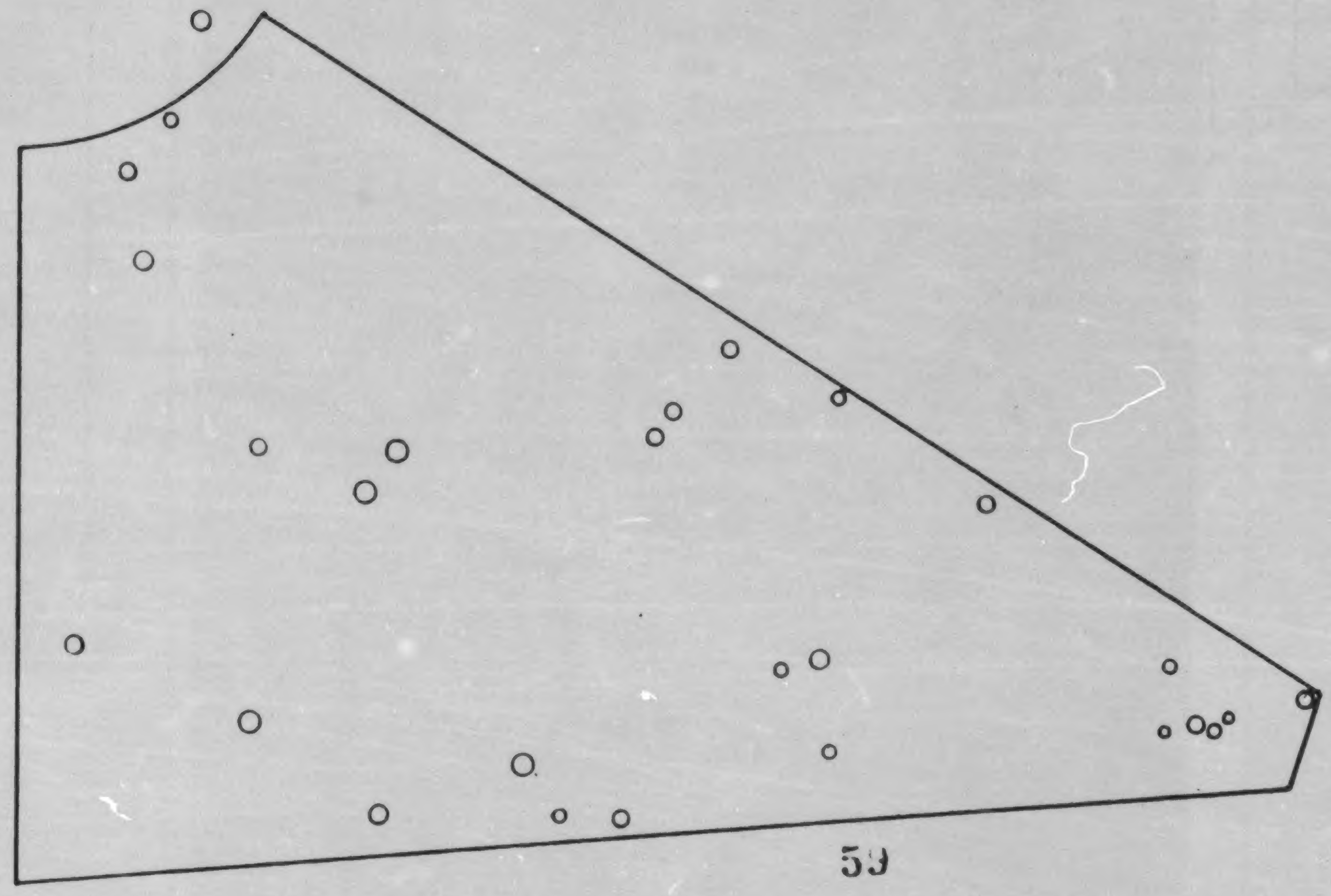
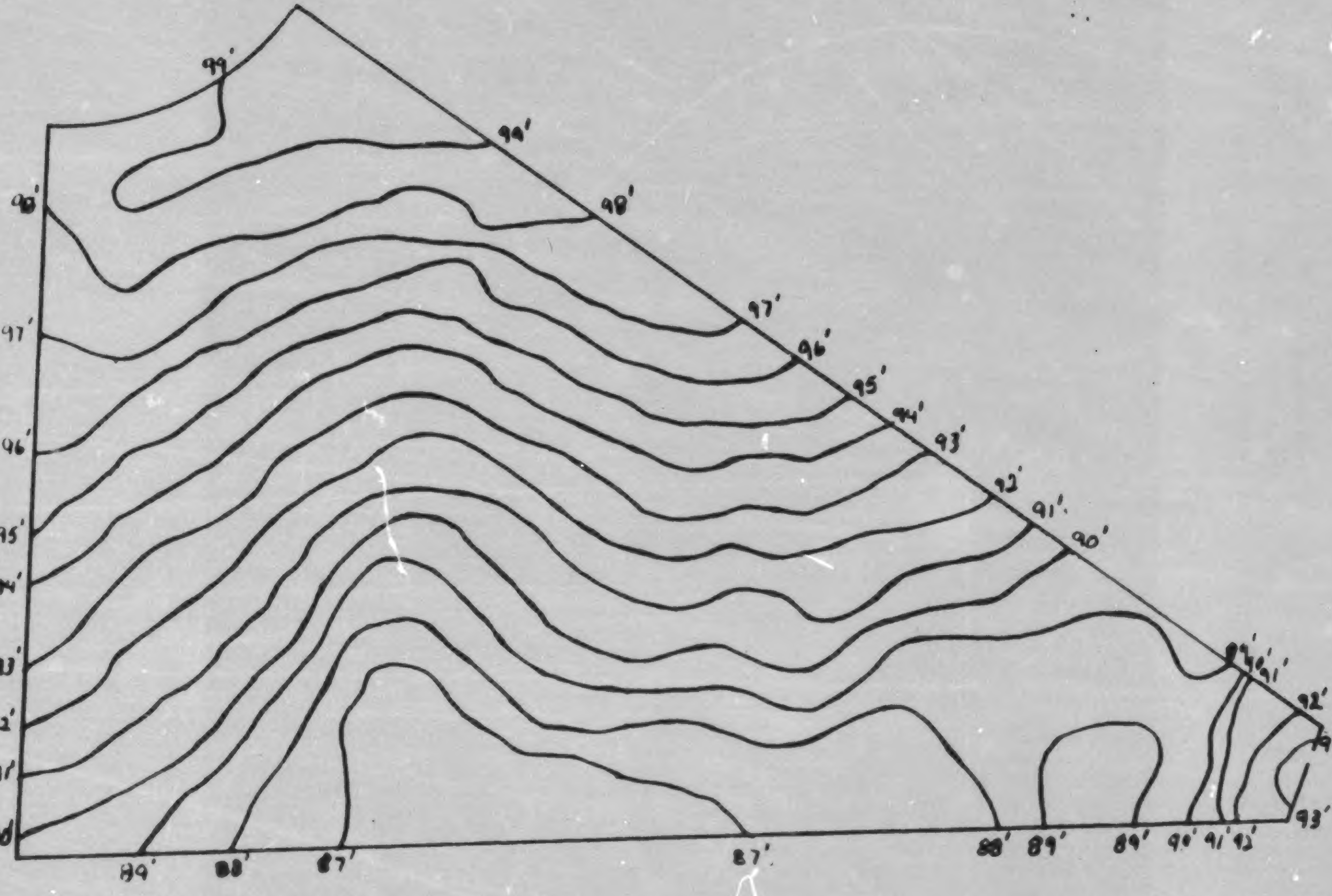
GRID LINES



VEGITATION & TREE LOCATION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CONTOURS

HOW DRAWINGS BECOME REALITY

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of what drawings do, some common uses for drawings by society and how industry makes use of drawings.

CONTENT OUTLINE:

1. What Drawings do
    - A. Describe industrial parts
    - B. Describe how parts are assembled
    - C. Layout systems (communication, transportation)
    - D. Establish limits
2. Societal uses
    - A. Layout operations
    - B. Instructions to contractors
    - C. Developmental planning
    - D. Organization Charts
    - E. Interrelationship between systems
3. Industrial Uses
    - A. Planning operations
    - B. Plant layouts
    - C. Planning assembly operations
    - D. On-site construction
    - E. Electronic assembly
    - F. Planning civil projects

TEACHER ACTIVITIES:

1. Make transparencies.

2. Obtain or develop samples of different types of drawings which can be used during discussions on different uses for drawings.

3. Present information relative to the differing uses for drawings.

4. Attend classroom discussions relative to drawing and their varied uses.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on the varied uses for drawings.

2. Each student will obtain a sample of some type of drawing and discuss how the drawing is used either by industry or the society in general.

3. Develop a sample set of drawings which are representative of industrial, civil, or societal activities within the community.

OUTLINE OF CONTENT

I. Brief History of Drafting

Even in ancient times, men drew pictures to show others what they had in mind. Only drawings give directions that are easy for builders to follow.

Some of the earliest builders made crude sketches on clay tablets that still exist. It is probable that they also made detailed plans of their buildings on parchment or papyrus, but we have not found any fragments of such drawings. The people of Mesopotamia used drafting materials as early as 2200 B.C. A statue of one of their kinds, Gudea, shows him with a drawing of a building on his lap.

Ancient Egyptian stone masons made plans for some pyramids and other buildings on papyrus, slabs of limestone and sometimes wood. They may have used large wooden T-squares, 8 or 10 ft. long, to draw the lines on the ground for the first layer of big stone blocks. Sailors of ancient Greece and Rome made rough maps of the world they knew. Perhaps they drew pictures and plans for their buildings, aqueducts and forts.

For centuries men struggled with the problem of drawing solid objects on flat surfaces. It was difficult to show accurately the dimensions of length, width, and height on drawings of two dimensions. Progress was slow until Leonardo da Vinci, and Italian genius of the fifteenth century (1452-1519), made a study of drawing and painting. His sketches were easy to understand and for several years he taught others his methods. After his death, other Europeans continued da Vinci's studies, but his teachings were not published until 1651. Among these scholars were mathematicians who explored different ways to show exact measurements on their drawings. Gradually they found how to draw more accurate pictures of the things they wanted to make. Gaspard Monge (1746-1818) a Frenchman of Napoleon's time, discovered the principles from which the system we use today has been developed. For some time his methods were considered a military secret.

Americans can take pride in the use they make of this pictorial language and in the advances they contribute to the art. George Washington and his officers used drawing instruments. In drafting history we can see the plans that Thomas Jefferson made for Monticello, his beautiful home in Virginia. At the United States Military academy, where every cadet learns to express his ideas of roads, bridges, machines, buildings, military operations, and so on in a pictorial way, another French scholar, Claude Crozet, taught Monge's projection methods of drawing for the first time in this country. American teachers and engineers added to Crozet's work and further developed this pictorial language. West Point graduates, among whom were the first trained engineers of our country, have often contributed to our technical progress. They have drawn pictures and plans for some of our railroads, bridges, public buildings, light-houses, canals, and atomic energy plants.

We usually find it difficult, and in most cases impossible, to describe in words the appearance of the things we want to make or build. Since words fail to give a complete or accurate description, we use pictorial sketches, drawings, diagrams, and photographs. Today there is hardly a newspaper, magazine, catalogue, or book without them.

Photographs are often used today to show what an object looks like. We also use perspective drawings to show an object as it appears to our eyes. However, such drawings and photographs do not know the exact shape and size of all the details of an object. A photograph or a perspective drawing does not show the inside parts or the exact way in which the pieces fit together. We need another kind of drawing to show this information.

Drawings that are known as projection drawings give exact details with accurate measurements. They provide the builder or manufacturer with the exact description that he needs to build what the designer has in mind. Projection drawings are more widely used than any other type of drawing. To make such a drawing, we view and draw an object from different sides. We draw its shape and the outline of its parts. We use different types of lines according to definite rules. We make the lines exact lengths (or proportional lengths), and we add measurements to show their true lengths. In this way, we project each view of the object onto our drawing paper.

We study drafting and the rules of projection drawing so that we cannot only make accurate drawings of our own, but also understand the drawings of others. Many of the troubles of the world are caused by the fact that various people do not understand one another. The infinite number of languages and dialects that contributed to this condition resulted from a lack of intercommunication of peoples widely separated in various parts of the world. Even today when communication is so greatly improved, the progress toward a world language is painfully slow; so slow, indeed, that we cannot foresee the time when it will be a fact.

Although men have not been able to get together on a world language of words and sentences, there has actually been a universal language in use since the earliest times: the graphic language. The idea of communicating thoughts from one person to another by means of pictures occurred to even the earliest cave dwellers, and we have examples still in existence to prove it. These earliest men communicated orally, undoubtedly by grunts and other elementary sounds, and when they wished to record an idea, they made pictures upon skins, stones, walls of cave or whatever materials they could find. As already stated the earliest forms of writing were through picture forms, such as the Egyptian hieroglyphics. Later, these forms were simplified and became the abstract symbols used in our writing today. Thus, even the letter character in present word languages have their basis in drawings.

A drawing is a graphic representation of a real thing, an idea, or a proposed design for construction later. Drawings may take many forms, but the graphic method of representation is a basic natural form of communication of ideas that is universal and timeless in character.

Man has developed graphic representation along two distinct lines, according to his purpose: (1) Artistic, and (2) Technical. It is our purpose to deal with the technical areas as a communication media.

Perhaps the first text on technical drawing in this country was Geometrical Drawing, published in 1849 by William Minifie, a high school teacher in Baltimore. In 1850 the Alteneder family organized the first drawing instrument manufacturing company in this country (Theo. Alteneder & Sons, Philadelphia). In 1876, the blueprint process was introduced in this country at the Philadelphia Centennial Exposition. Up to this time, the graphic language was more or less an art, characterized by fine-line drawings made to resemble copper-plate engraving, by the use of shades, lines and by the use of water color "washes." These techniques became unnecessary after the introduction of blueprinting of modern technical drawing. The graphic language now became a relatively exact method of representation, and the building of a working model as a regular preliminary to construction became unnecessary.

Up to about the turn of the nineteenth century throughout the world, drawings were generally made in what is called first-angle projection, in which the top view was placed under the front view, etc. At this time in the United States, after a considerable period of argument pro and con, practice gradually settled on the present third-angle projection in which the views were situated in what we regard as their more logical or natural positions. Today, third-angle projection is standard in the United States, but first-angle projections is still used throughout much of the world.

During the early part of the twentieth century, many books on the subject were published in which the graphic language was analyzed and explained in connection with its rapidly changing architectural design and applications.

Architectural drawings are concerned with the representation and specification of buildings and structures of various kinds. Although the general principls are the same as for other technical drawings, there are certain methods of representation, conventional symbols, and practices that are necessary because of the relatively small scale uses for architectural plans.

In addition to working drawings, pictorial drawings are used to show how the completed structure will look. Such pictures together with preliminary or sketch plans present both exterior and interior features and arrangements and provide a basis for starting the working drawings.

However, before starting the working drawings, several preliminary drawings may need to be made for consideration of the general design, exterior appearance, and plan layout. These are gone over until they are satisfactory and meet with client's approval. Drawings such as seen in the transparencies (Numbers 1.24 thru 1.33 inc.) can then be made to clarify the whole design.

Working drawings are based upon orthographic projection (discussed later in section on Mechanical Engineering and then in more detail in section on Industrial Engineering) with dimensions and notes added.

Such drawings must conform in style with good practice as followed in the office where they are made. There must be contrast, which is obtained by giving proper values to the various lines that compose the views. Figures that are easy to read, uniform lettering, and the use of standard terms are essential. When completed, a working drawing must be thoroughly checked for errors and improvements before being submitted for approval.

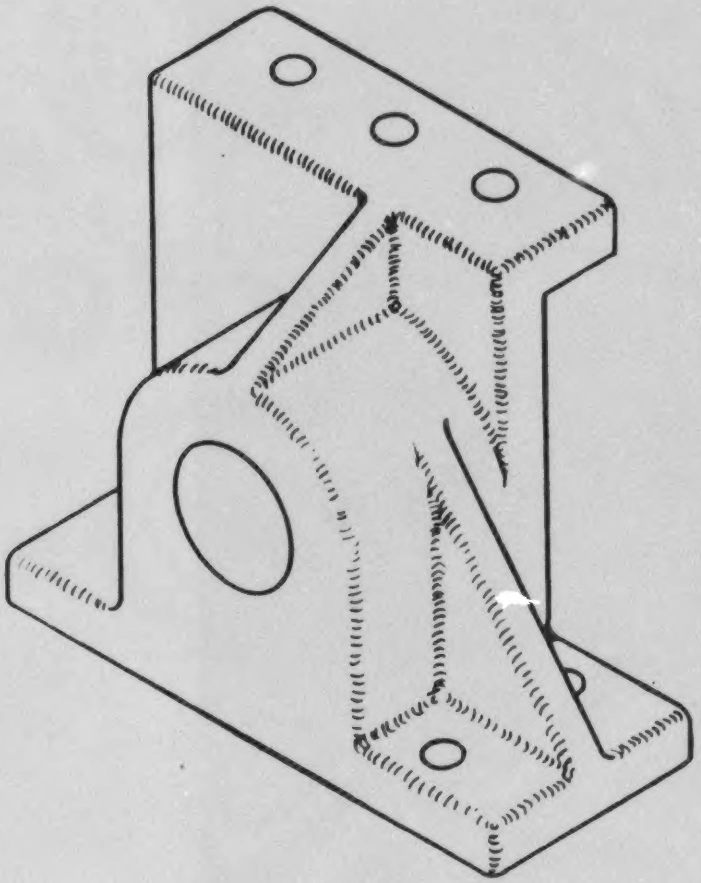
II. Objectives in Drafting:

1. Accuracy: No drawing is of maximum usefulness if it is not accurate. The student must learn from the beginning that he cannot be successful in his college career or later in his professional employment if he does not acquire the habit of accuracy in his work.

2. Speed: "Time is Money" in industry, and there is no demand for the slow draftsman or engineer. However, speed is not attained by hurrying; it is an unsought by-product of intelligent and continuous work. It comes with study and practice, and the fast worker is usually mentally alert.

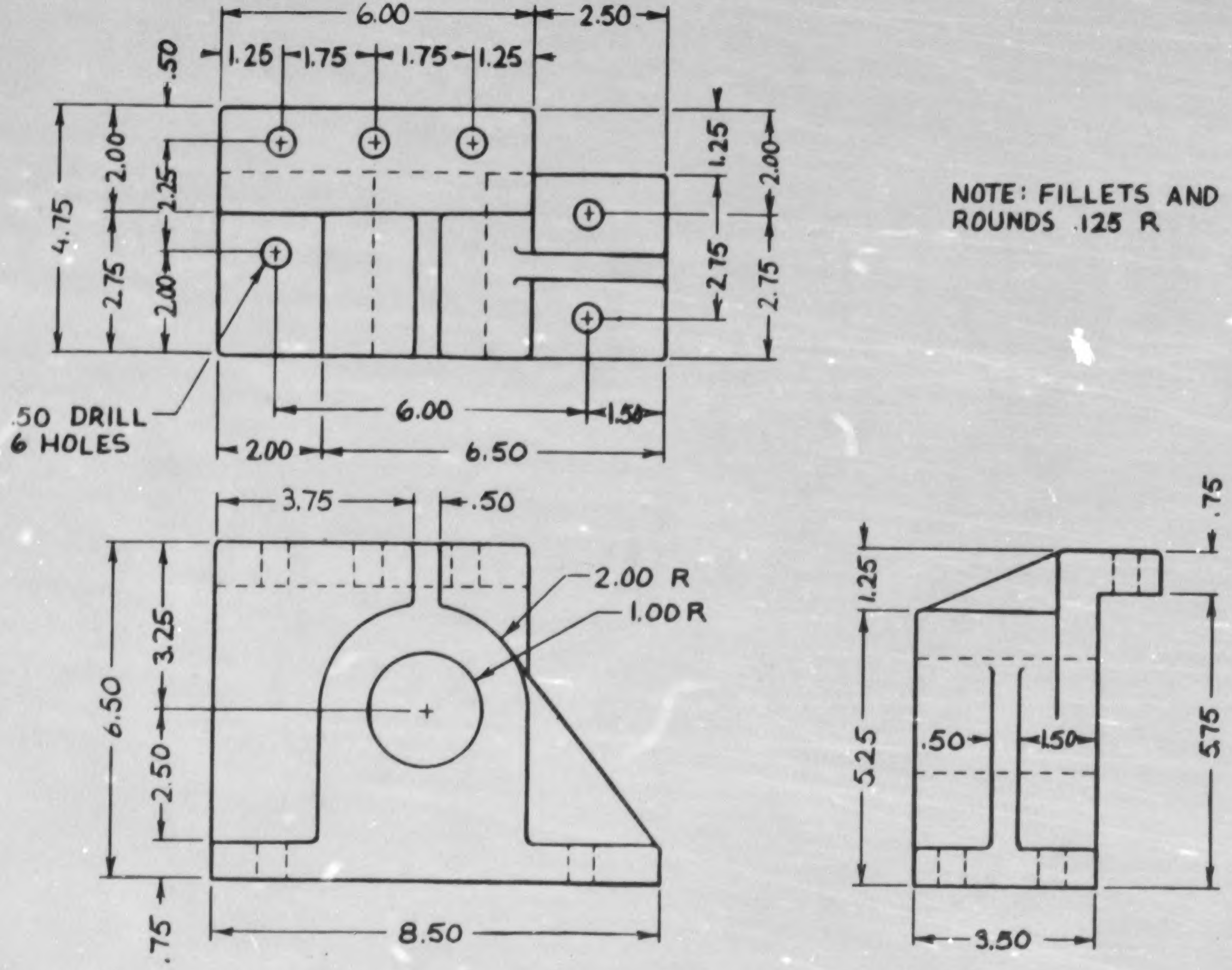
3. Legibility: The draftsman or engineer should remember that his drawing is a means of communication to others, and that it must be clear and legible in order to serve its purpose well. Care should be given to details, especially to lettering.

4. Neatness: If a drawing is to be accurate and legible, it must also be clean; therefore, the student should constantly strive to acquire the habit of neatness. Untidy drawings are the result of sloppy and careless methods, and will not be accepted by the instructor.



67

ISOMETRIC VIEW



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NOTE: FILLETS AND ROUNDS .125 R

Imaging the Developed Idea

by Ed Antrim and J. B. Fallis

Definition

A working drawing is used to give information for the manufacture or construction of a machine or the erection of a structure. Knowledge for the production of a machine or structure is given by a set of working drawings conveying the facts fully and explicitly so that additional instructions are not required.

The description given by a set of working drawings will include:

1. Graphic representation of the shape of each part (shape description)
2. Dimensions of each part (size description)
3. Explanatory notes (general and specific) giving the specifications of material, heat-treatment, finish, etc.
4. Descriptive title
5. Description of the relationship of each part to the others (assembly)
6. Parts list or bill of material

A set of drawings will include, in general, two classes of drawings:

1. Detail drawings, giving the information included in items 1-4

2. An assembly drawing, giving the location and relationship of parts, item 5

Engineering procedure

When a new machine or structure is designed, the first drawings are in the form of freehand sketches on which the original ideas are worked out. Working from the sketches and calculations, a design assembly (also called a "design layout" or "design drawing") is produced. This is a preliminary drawing on which details of the design are worked out. It is accurately made with instruments, full size if possible, and shows the shape and position of the various parts. No attempt is made to show all the intricate detail, only essential dimensions (such as basic sizes) are given. On the drawing (or in a set of written notes) will be the general specifications for materials, heat-treatments, finishes, clearances or interferences, etc.

Working from design drawing and notes, drafting detailers complete the individual detail drawings. On a detail drawing, the views necessary for complete shape description of a part are provided, and all necessary dimensions and manufacturing directions are given.

A set of drawings is completed with the addition of an assembly drawing and a parts list or bill of material.

If a machine is to be mass produced, "operation" or "job" sheets will be prepared describing the separate manufacturing steps required and indicating any special tools required (jigs, fixtures, etc). The tool designer working from the detail drawings and the operation sheets, will design and make the drawings for the special tools.

Assembly drawings

An assembly drawing is a drawing of the machine or structure put together, showing the relative positions of the different parts.

Since the design drawing is the preliminary layout on which the scheming, inventing, and design drawing. More often it is drawn from dimensions on the detail drawings; providing a valuable check on the accuracy of the detail drawings.

The assembly drawing gives the overall dimensions and the distances between centers or from part to part of the different pieces (thus fixing the relation of the parts to each other and aiding in making the machine). However, an assembly drawing may need no dimensions.

Assembly drawings usually have reference letters or numbers designating the different parts. These numbers (sometimes enclosed in circles called "balloons," with a leader pointing to the piece) are used in connection with the details and bill of material.

Developing the Idea

by Ed Antrim and J. B. Fallis

In developing an idea to a stage which it may serve as a more valuable communication tool, the design of the idea needs to be evaluated.

From the first steps of recording the idea in a sketch form, the functions of design need to be considered.

The use of standards will be valuable in the process. The standards may consist of standard practices of limitations; such as, the design of a house around a standard 8'0" ceiling or the design of a chair to fit the average man's body. The standards may consist of standard parts.

Standard parts are ready-made items that are available at stores and other marketing businesses. Standard parts vary from simple items such as nails to complex items, including motors, transmissions, and products. Thus, they can be produced in large quantities, reducing costs through the efficiencies of mass production.

The use of standard parts provides several opportunities for conservation of time, ability, and materials. Usually, standard parts offer:

1. A reduction in the cost of producing the product.

2. A replacement of worn or damaged parts in the basic product with more ease and with less cost.

3. An elimination of the repetitive tasks involved in designing parts that have already been developed.

The use of standard parts allows the designer to use his talent in developing the unique features of the product.

Aesthetic appeal is probably one of the more important design functions which should be considered in the developing of an idea or "product." Aesthetics, or principles of design, are usually considered along with the planning for function. A successful product must function well, but a purely functional product will not sell as well as an attractive functional product.

How, then, does one make a product pleasing to observe without defeating its functional purpose? It has been implied that appropriate materials can be both functionally adequate and pleasing to the eye. Although one has never been seen, a coffee table supported by a short piece of 12" steel I-beam would be an example of sacrificing aesthetics for function. On the other hand, a circular picnic bench with a built-in lazy susan in the center of the table top has been invented. The idea for such a picnic table wasn't a bad one, but the choice of materials for the lazy susan was poor. The lazy susan was made from an old wagon wheel 36" in diameter with a hub 12" thick. The result was that the wheel blocked the line of vision of everyone sitting at the table, and it was too high and too far for anyone to reach the food on it without standing up.

A sensitivity for pleasing design should be developed by all designers. The product must meet with customer approval, but designers should never compromise their ability to help the customer appreciate better design.

Before an industrial product is put on the market, careful consideration is given to its appearance and to the appearance of the package into which it is placed for shipping, display and sale. During the last forty years, an increasing amount of attention has been given to the appearance of industrial products. It is generally accepted both by industry and the consumer that products should be functional as well as "pleasing to look at."

Even though a long, thin tree branch with a piece of string tied on it and a bent safety pin hook may be used to catch fish, more functional and more appealing is available for anyone with fishing fever and a twenty dollar bill. This may suggest that it costs money to improve the appearance of a product--it does, but the consumer is usually willing to pay the price. In fact, more consumers are likely to buy the better looking spin-casing outfit for fishing than are likely to make a tree branch fishing pole. Thus, the manufacturer sells more of his better looking, functional, expensive product and thereby increases his profit.

Product planning is one of the most creative kinds of work to be found. Large amounts of money are spent in industry for research and development. Long periods of time may be required between the conception of an idea for a product and its final manufacture.

Even more time is spent on redesigning products already on the market than is spent designing new products. For example, although "new" cars come out each year, the old model automobile is simply redesigned. It takes several years of "lead" time to develop and manufacture the changed design parts for introduction of the car in early fall. The tools of communication during this period of development include sketching and drafting.

This redesign may result from safety factors or environmental considerations such as the future addition of air bags in automobiles and the anti-pollution devices. These factors should be considered during these early stages of design. As the safety and environmental factors have arisen from consumer's pressure on the federal and state governments to legislate regulations, the consumer must certainly be considered. The consumer constitutes success or failure.

In the development stage of an idea or product, a particular company might want to consider questions such as these: Is the product related in some way to the products we already produce? Will it extend our coverage and reputation now held? Is the product one which lends itself to the production facilities now used? Are expensive new machines required to produce it? Is the engineering and labor force capable of producing the product? Will it take a minimum amount of time to change over and tool-up for the initial production run? Will the product meet its competition? Can it be sold at a reasonable profit? Will it have a natural obsolescence so that orderly replacement will be needed? Can the money to finance the production be obtained?

After the commitment is made to continue the development process, the designers may be granted permission to build models or mock-ups of their idea. There are three general kinds of mock-ups.

The first is the paste-up. This is a very rough mock-up using any material that is suitable. Cardboard is very good. The paste-up gives the designer something to work with and a better idea about the design solution. The paste-up is seldom shown to people who are not designers.

The next kind of mock-up is the appearance mock-up. This shows what the product will look like. It too is made out of any suitable materials, usually wood and cardboard. In most cases no parts function (work). For example, if it is a sewing machine, none of the knobs or levers will work, although they look as if they would. At this stage, it is possible to show design variations (differences in small details). If a line of products ranges from inexpensive to deluxe models, the different modifications (changes) can be shown as appearance mock-ups.

The appearance mock-up shows, for the first time, a picture of the design solution that is easy to understand and correct. Someone who cannot easily imagine what something looks like from drawings will have no trouble understanding a mock-up of this kind.

The appearance mock-up, however, only looks like the product. Even though it shows the appearance in a fairly accurate (correct) way, it cannot be handled and used. The weight is not the true weight of the product. Some of the parts do not show the actual finishes. For example, chrome plating may be shown by silver paper.

When the appearance mock-up has served its purpose, a longer lasting and more exact mock-up is needed. This is called hard mock-up. It is made of metal and wood. Many of the parts will work as they would on the final production model. For example, handles, doors and lights work; control knobs turn. But the mechanical parts that make the product work are not included. Thus, a refrigerator mock-up would not have a cooling system. The hard mock-up is used for final explanations, engineering studies, producibility studies, and further design improvement.

Mathematical models may serve the same purpose of the mock-up as well. At International Harvester Company, Hinsdale, Illinois, computer graphics is used as an engineering design tool to study, evaluate and experiment with a wide range of possible designs for industrial and construction equipment.

Engineers take a close look at designs for loaders, backhoes, and similar equipment, viewing various choices on the cathode ray screen of an IBM 2250 display unit, with input derived from an IBM System/370 Model 155 computer. The designer displays graphs or actual models of equipment, altering the design by using a light pen attached to the display unit. The computer stores a mathematical model of the equipment being engineered; this permits the designer to alter the model until satisfied.

By using the light pen, the engineer moves a design to any working position and gets information on such features as digging force, pin loads, and dumping heights. The 2250 also displays diagrams showing force vectors, digging profiles, and lift capacity.

As you should realize by now, the ways of developing and idea may be varied and technical as the idea above. All the aids serve as a way of checking the model against the proposed design functions.

STARTING TO DRAW

UNIT OBJECTIVE:

Upon completion of this unit, the students will demonstrate basic knowledge of sketching, the alphabet of lines and lettering.

CONTENT OUTLINE:

1. Sketching
    - A. Straight lines (vertical & horizontal)
    - B. Squares
    - C. Angles
    - D. Circles
    - E. Arcs
    - F. Ovals
    - G. Curves
2. Alphabet of lines
    - A. Types of lines
    - B. Line weights
    - C. Uses of different lines
3. Lettering
    - A. Gothic letters
        - a. Inclined
        - b. Vertical
    - B. Letter size
    - C. Pencil position
    - D. Pencil point preparation

TEACHER ACTIVITIES:

1. Make transparencies.
2. Obtain or develop samples of different types of sketches, lines commonly used in drafting and lettering common to all types of

drawings.

3. Present information relative to sketching, the alphabet of lines and lettering.

4. Attend classroom discussions relating to sketching, the alphabet of lines and lettering.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on sketching, the alphabet of lines and lettering.

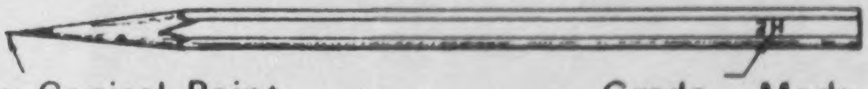
2. Complete assigned sketching exercises (see attached).

3. Complete assigned line exercises (see attached).

4. Complete assigned lettering exercises (see attached).

Pencils and Pencil Lead Grades

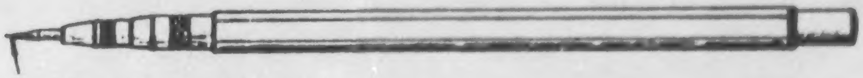
DRAWING PENCIL


2H
Sharp Conical Point
Grade Mark

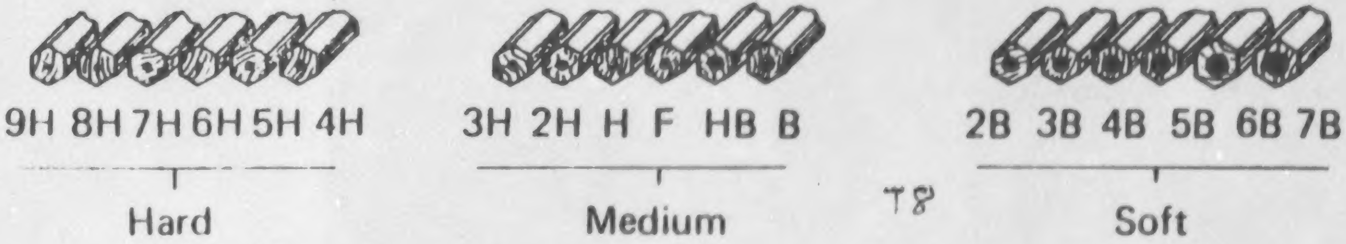
For General Linework and Lettering

Do not sharpen this end!

MECHANICAL PENCIL

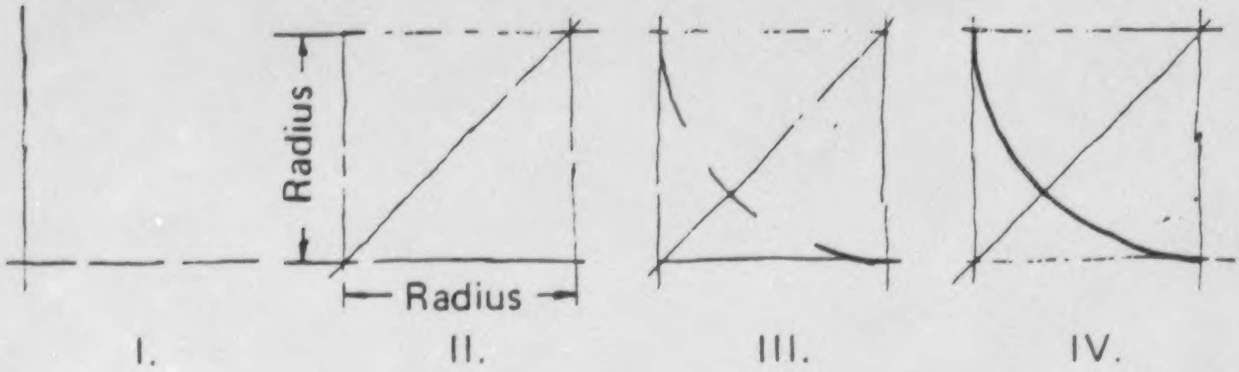

Drafting Pencil Leads

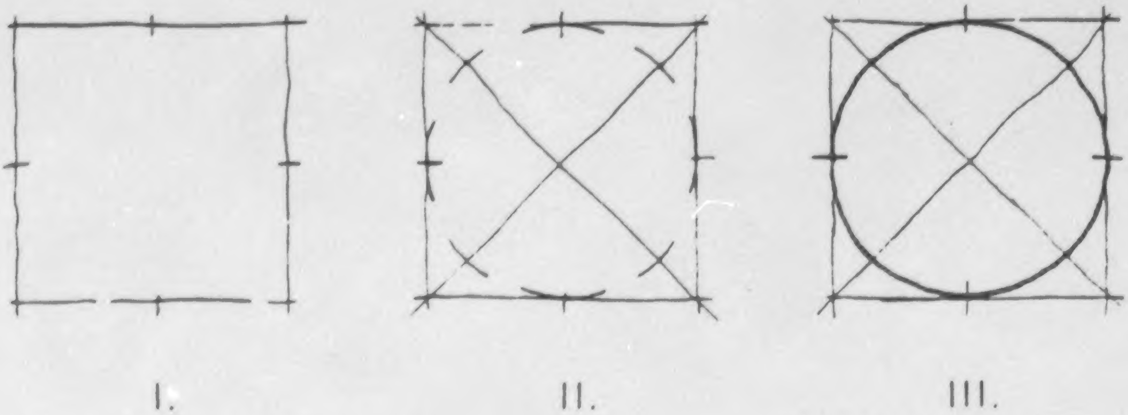
Available in all grades

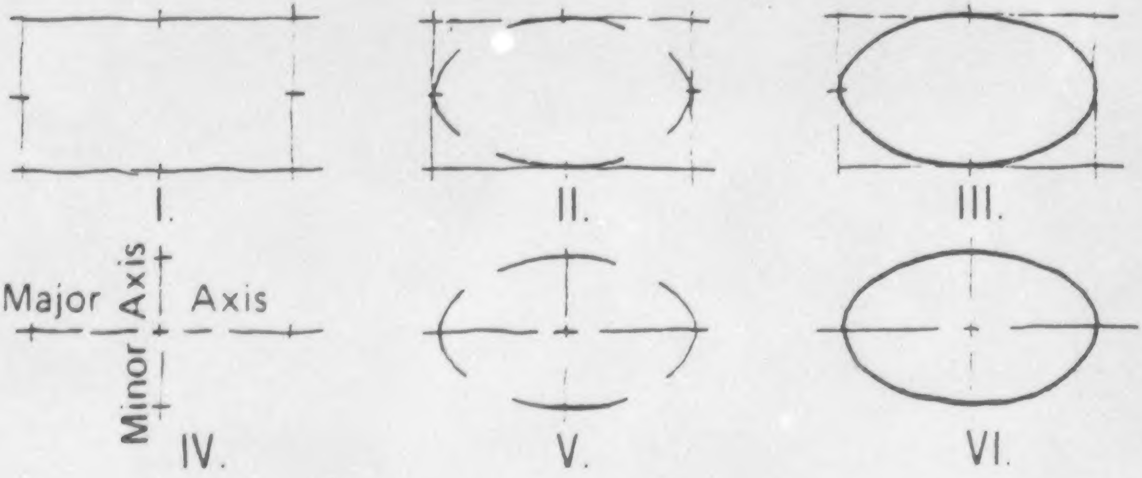

9H 8H 7H 6H 5H 4H
Hard
3H 2H H F HB B
Medium
2B 3B 4B 5B 6B 7B
Soft

T8

Sketching Arcs, Circles, and Ellipses


Radius
Radius
I.
II.
III.
IV.




I.
II.
III.
Major Axis
Minor Axis
IV.
V.
VI.

MEASURING

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of measurement, to include how to measure; precision measurement; measuring angles; and measurement systems.

CONTENT OUTLINE:

1. Development of measures
   A. English
   B. Metric
2. Precision Measurement
   A. Micrometers
   B. Vernier calipers
   C. Gage blocks
   D. Machinist scale
3. How to measure
   A. Engineer scales
   B. Architectural scales
4. Measuring angles
   A. Protractor
   B. Tri-angles
5. Measuring systems

TEACHER ACTIVITIES:

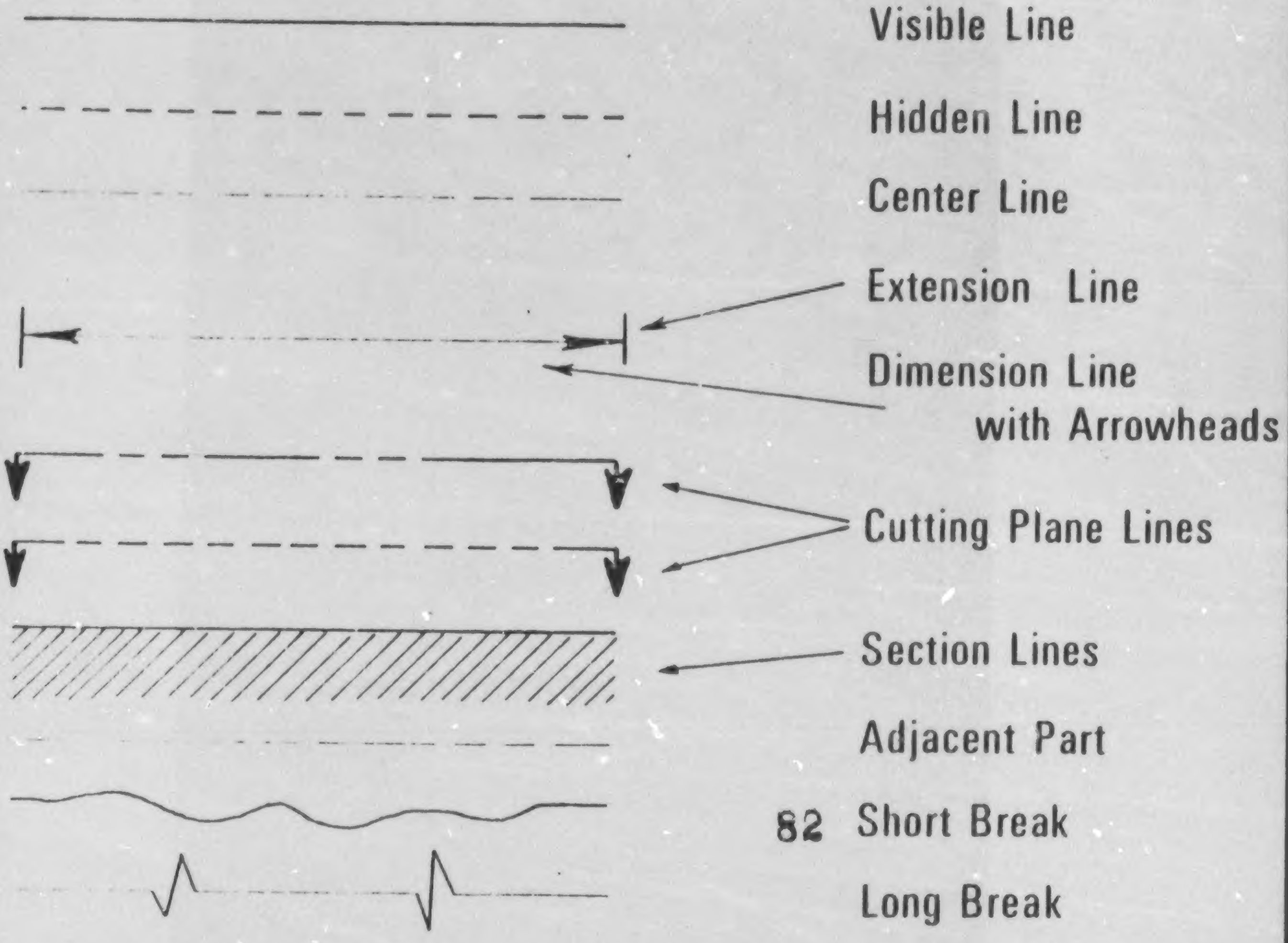
1. Make transparencies.
2. Obtain examples of different types of measuring devices.
3. Present information relative to content outline.
4. Attend classroom discussions relating to measurement procedures.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on measurement and measurement related procedures and systems.

2. Complete assigned exercises relating to measurement and measuring procedures.

Alphabet of Lines



Visible Line

Hidden Line

Center Line

Extension Line

Dimension Line
with Arrowheads

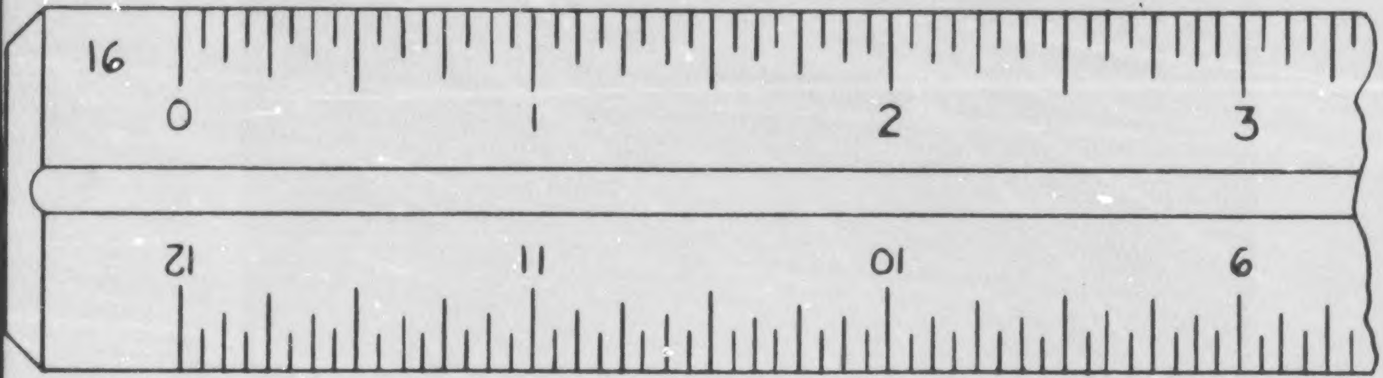
Cutting Plane Lines

Section Lines

Adjacent Part

Short Break

Long Break


16
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3
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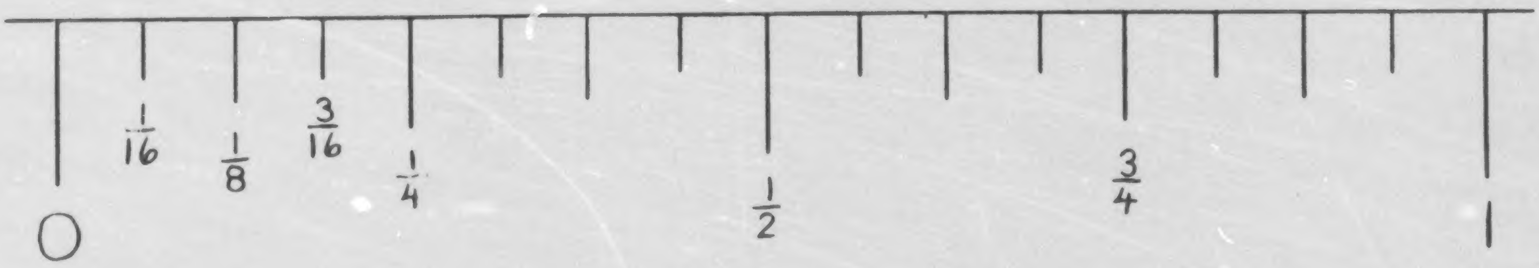
11
10
9

SIXTEENTH INCH SCALE


0
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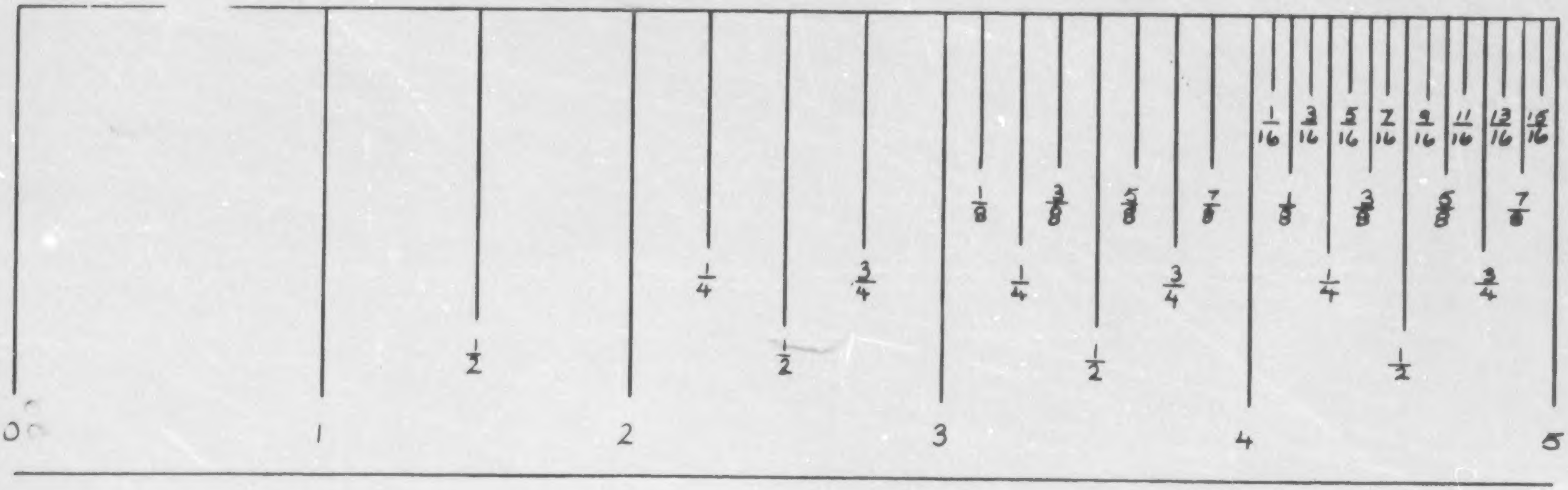
1/8
3/16
1/4
1/2
3/4
1

ONE INCH OF SIXTEENTH INCH SCALE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9/16
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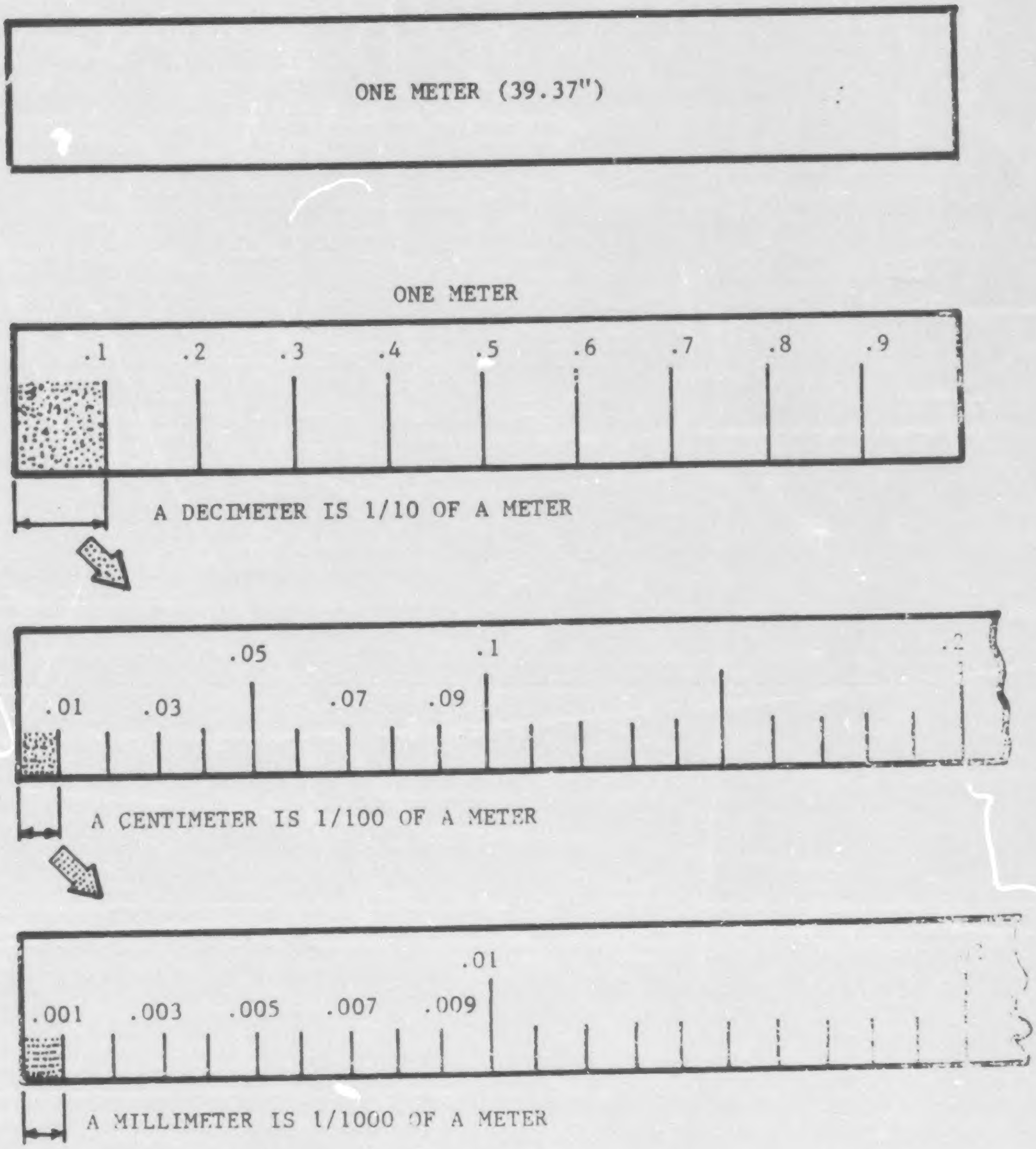
3/4
13/16
7/8
15/16
5

DECIMAL PARTS OF A METER


ONE METER (39.37")
ONE METER
.1
.2
.3
.4
.5
.6
.7
.8
.9
A DECIMETER IS 1/10 OF A METER
.05
.1
.01
.03
.07
.09
A CENTIMETER IS 1/100 OF A METER
.01
.001
.003
.005
.007
.009
A MILLIMETER IS 1/1000 OF A METER

88

DIMENSIONING

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of dimensioning to include the purpose of dimensions; dimension and extension lines; size and location dimensions; and basic dimensioning techniques.

CONTENT OUTLINE:

1. Purpose of dimensions
2. Dimension and extension lines
    A. Arrowheads
    B. Lines
3. Size and location dimensions
4. Dimensioning techniques
    A. Basic rules
    B. Placement
    C. Special considerations
    D. Applying dimensions
    E. Unidirectional and aligned dimensioning
    F. Dimensioning isometrics
    G. Architectural

TEACHER ACTIVITIES:

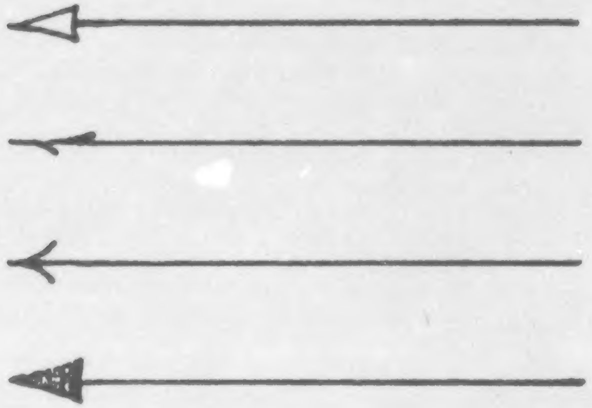
1. Make transparencies.
2. Obtain examples of drawings showing the correct use of dimensions.
3. Present information relative to content outline.
4. Attend classroom discussions relating to dimensioning and dimensioning practices.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on dimensioning and dimensioning practices.
2. Complete assigned exercises relating to dimensioning and correct dimensioning practice.

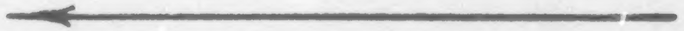
Arrowheads

INCORRECT FORMS



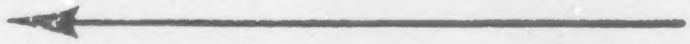
CORRECT FORMS

Conventional

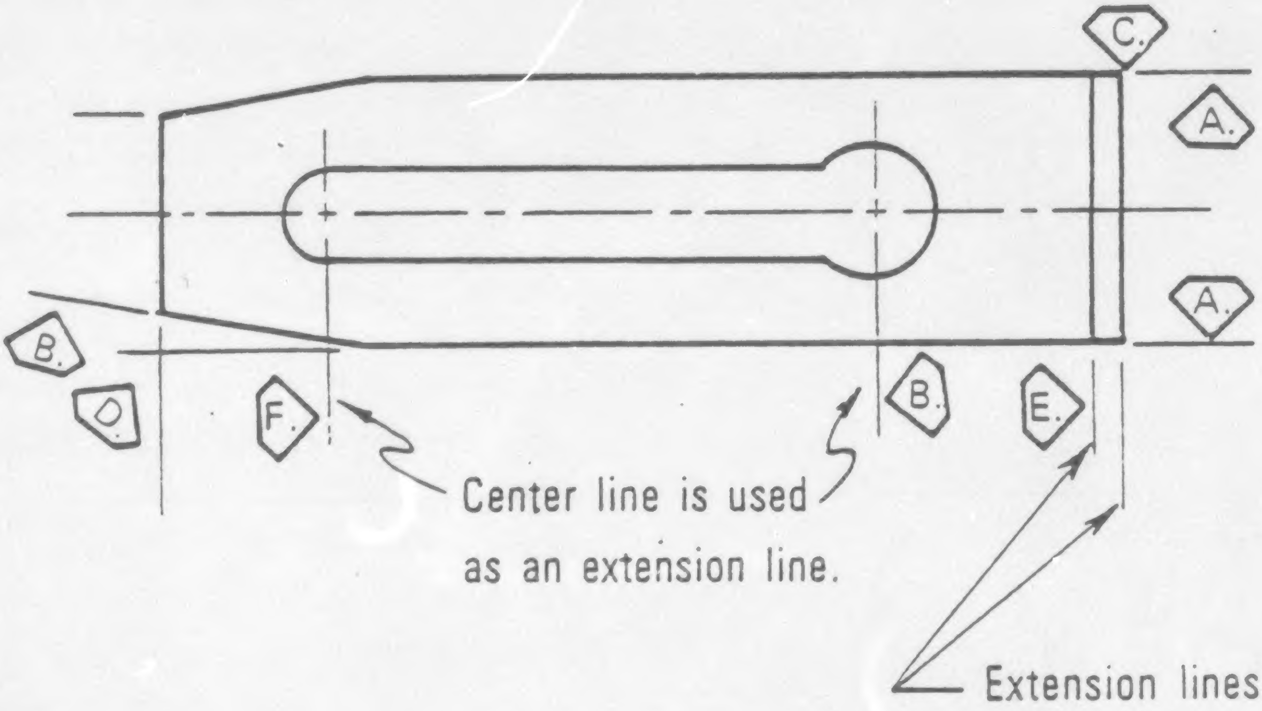


.90

U.S.A. Standards

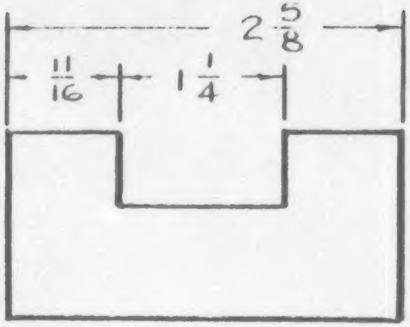


Dimensioning Rules


C.
A.
A.
B.
D.
F.
B.
E.
Center line is used as an extension line.
Extension lines

Placement of Dimensions

(A.)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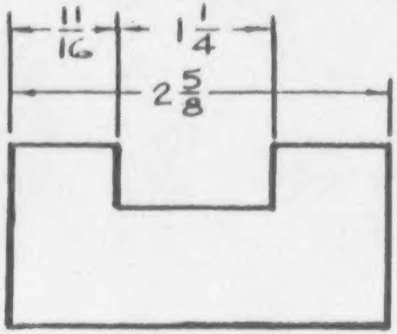
11/16
1 1/4

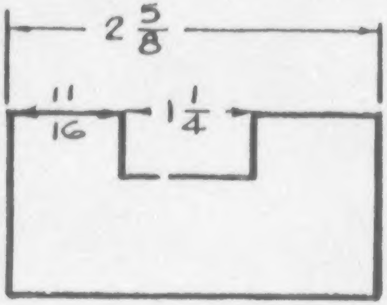
Correct

(B.)


11/16
1 1/4
2 5/8

Incorrect

(C.)


2 5/8
11/16
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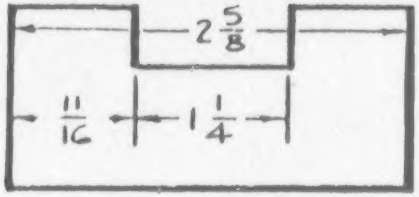
Incorrect

(D.)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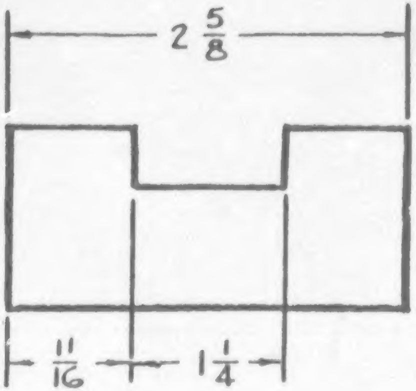
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Incorrect

DRAWING MECHANICALLY

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of orthographic projection and its application to drafting.

CONTENT OUTLINE:

1. Orthographic projection
    - A. Theory
    - B. Placement of views
    - C. Hidden lines
    - D. Correct views to draw
    - E. Steps in drawing orthographic projection
2. Working drawings
    - A. Purpose
    - B. Uses

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to content outline.
3. Demonstrate current procedures for drawing orthographic projections.
4. Attend classroom discussions covering orthographic projection.

STUDENT ACTIVITIES:

1. Participate in lecture discussions concerning orthographic projection.
2. Demonstrate the ability to provide working drawings using orthographic projection.
3. Complete assigned exercise designed to develop proficiency in orthographic projection.

Orthographic Projection

by Larry Malone

The basic premise of technical graphic communication is that every detail of size and shape of an object may be understood and reproduced by anyone, no matter what his country. Technical graphic communication uses a universal language of design so that communication may take place on a visual level. Orthographic projection is a commonly used techinque in this communication. Through use of orthographic projection, all facets of an object can be understood and manufactured in the same way by many people from varied backgrounds and countries.

THEORY OF ORTHOGRAPHIC PROJECTION

In orthographic projection, the shape of an object is duplicated by dropping perpendicular light rays from two or more sides of an object to an imaginary plane. There are three planes used in orthographic projection: horizontal plane, frontal plane, and profile plane. These planes are very important because they show all sides of the object completely (see Figure 1 following reading).

What is orthographic projection? It is the use of different views to describe an object. The different views used are: front, top, right side, left side, rear, and bottom. The front, top and right side are most commonly used because most objects can best be explained by these three views (see Figure 2 following reading).

Example of orthographic view: the rectangle is probably the easiest figure to explain in an orthographic view. When viewing the rectangle, the view which shows the overall width and height is called the frontal view. The view showing the width and depth is the top view. The depth and height are the side views (see Figure 3 following reading).

To explain how we arrive at the views of orthographic projection for the rectangle, let us take that same rectangle and place it in a transparent box. Looking at the rectangle you can see that it has six sides. To describe this rectangle we will use only the three common views: top, front, and right side. The transparent box will become planes on which you will record the view. Remember that in the theory of orthographic projection you will drop or project perpendicular rays to the object. When the rays pass through the transparent box, an image is reflected on the glass.

Placement of the views

Once you have recorded the views on the planes of the box you must place them in an order so that all can tell what view is being shown. The correct placement is--the top view is placed directly above the front view and the right view is placed directly to the right of the front view (see Figure 4 following reading). The views will always be placed in this order. To keep all orthographic views in the correct position is a universal law in technical graphics.

Hidden Lines

When viewing through the transparent box, you can see only the front face of the object and nothing behind that face. Since it is necessary to describe every part of an object, you will place hidden lines in the areas which cannot be seen in that view. To show these hidden lines, place short dashes to show that part of the object which cannot be seen.

Hidden line__ __ __ __ __ __ __ Dashes 1/8" plus or minus
Spaces 1/32" plus or minus

(See Figure 5 following reading) The first dash of a hidden line always touches the line from which it starts. If a hidden line is a continuation of a visible line, a space is left between the visible line and the first dash of the hidden line.

When the center line and a hidden line occupy the same position, the hidden line is drawn.

When a hidden line crosses a visible line, the visible line should not be crossed with a dash.

Center Lines

Center lines are to be drawn in to locate the center point of arcs and circles. They also aid in the location of views and in dimensioning.

Center line____ __ ____ __ ____ Space 1/32" plus or minus
Long dash 3/4" to 1-1/2" plus or minus
Short dash 1/16" plus or minus

Correct view to draw

We have already mentioned that six views can be used, but all are not needed to describe most objects. The general characteristics of an object indicate the views required. Three views will describe most objects well, but in some cases more or fewer views are required.

Most objects have a characteristic view by which they can be recognized. This is the first view to consider for the front view.

Views with the fewest hidden lines are easiest to read and take much less time to understand.

Do not draw views which are unnecessary. For example, a cylinder shaped object will only need two views: top and front. If the right side is drawn, this will be a repeat of the front view.

Irregular shaped surfaces should be placed so that the irregular shape can be seen to the fullest.

Consider using the three common views first (front, top, right side). If these do not sufficiently describe the object, then make use of the other three views.

STEPS IN DRAWING ORTHOGRAPHIC PROJECTION

1. Determine the views needed to describe the shape of the object. Choose the view which will show the object completely with the least amount of hidden lines. This would be the front view. The view should also show the overall width and height of the object.

2. Determine the number of views needed to clarify the drawing. You will always need at least two views. The views most commonly used are the front, top, and right side.

3. Correct location of the views

    a. Measure the length of the paper.
    b. Add the width and depth together.
    c. Divide this measurement by three to gain equal spacing between the object and the sides of the paper.
    d. Measure the height of the paper.
    e. Add the height and depth together.
    f. Divide the above measurement by three to gain equal spacing.

4. Layout and draw the principle measurements of width, height, and depth.

Note: All lines should be drawn with a 6H pencil first and then darkened in with a 2H or "F" pencil.

5. Lay out all other measurements--center lines, hidden lines, arcs, circles or any additional lines to finish the drawing.

6. When all lines are in the views correctly, darken in the lines by using an "F" or "H" pencil.

I. Drafting in Mechanical Engineering

Aside from general idea sketches, there are two main classes or drawings: (1) artistic and (2) technical. The artist expresses philosophic or aesthetic ideas or emotions. When he draws things, he draws them as they appear to him emotionally, and every artist sees things in his own peculiar way. The technical man is concerned with actual objects, and his drawings show not only how they appear, but how they are. Technical drawing is an exact means of expression, and accuracy is the main objective.

Every new invention or development starts with an idea in the mind of the originator. If he is an engineer, an inventor, or a designer, he will make the drawing himself because he is the only person who can express exactly what he has in mind. Such a person is usually well trained in drafting anyway, and finds it easy to set an idea down in this way. The difficulty is getting the new idea! Usually such an idea develops through several stages, starting probably with a free-hand sketch. This is followed by one or more mechanical drawings, or layouts, drawn accurately with instruments.

Whenever the designer is satisfied with the general scheme, the working drawings are made to be used in the shop. The designer may make these himself or he may turn the work over to the draftsman. In the course of making these working drawings, many details of construction may be worked out, and the draftsman may be required to be somewhat of a designer himself. Salaries of draftsmen depend pretty largely upon how much "head work" or designing they are able to do. The young draftsman is in a very favorable position to learn all about the products of the company and to advance rapidly to key positions if his ability warrants it.

A working drawing is a complete drawing or set of drawings such that the object represented can be built from it alone without additional information. Such a drawing is a description of the object and is composed of two parts, the views and the dimensions.

Just as in the written language, the graphic language has its grammar and its symbols. The alphabet of lines and the rules of presentation are examples of this.

By means of views, the mechanic can visualize the object to be built; if the drawing is right, he will visualize exactly what the designer has in mind. This ability to visualize or "think in three dimensions" is essential to the designer, the draftsman, the mechanic, and all other people in technical work. It is one of the principal values to be derived from the study of industrial drafting. It is also one of the best means of developing the "constructive imagination" so essential in all original designing.

By means of dimensions, the mechanic can tell exactly what size each part is to be. This applies not only to large dimensions or rough measurements, but in many cases to extremely accurate measurements often down to a ten-thousandth of an inch or less.

Thus, the working drawing gives a complete story and industrial prints made from it can be mailed to factories in any part of the country of the world. Also, all the separate parts can be made exactly as planned and then shipped to a central assembly plant where they will fit into the assembly as intended.

Terms and Definitions

1. Angle: Two straight lines that meet at one end. The size of the angle is determined by what part of a circle the angle occupies.

2. Degrees: The measurement of an angle according to what part of a circle it occupies. 360 degrees in a circle.

3. Horizontal: A line straight across and parallel to the horizon.

4. Hidden object line: A line of small dashes used to show detail that you cannot see from your point of view.

5. Isometric view: A drawing that shows all three sides of an object with the three sides connecting.

6. Orthographic views: A drawing that shows three sides of an object separated into front view, top view, and the right side view.

7. Parallel: Lines that are the same distance apart the whole length of the lines.

8. Vertical: Straight up and down.

9. View: What you can see from the direction you are looking at an object.

10. Front view: What you can see looking straight on the front side of an object.

11. Top view: What you can see looking straight down on the top of an object.

12. Right side view: What you can see looking straight on the right side of an object.

13. Visible line: A solid line used to outline and draw visible surface detail on it.

SECTIONING

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of sectioning and its application and use in drafting.

CONTENT OUTLINE:

1. Types
    - A. Full section
    - B. Half section
    - C. Quarter section
2. Section lining procedures
    - A. Correct
    - B. Incorrect
3. Common material symbols

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Demonstrate correct sectioning procedures.
4. Attend classroom discussions covering sectioning procedures.

STUDENT ACTIVITIES:

1. Participate in lecture discussions concerning sectioning practices.

2. Demonstrate the ability to produce working drawings which incorporate the use of sectioning.

3. Complete assigned exercises designed to enhance student proficiency in the use of sectioning.

Sectioning

by David Almes

Through the early lessons of this topic we learned that when parts cannot be seen they are shown as hidden lines in their respective views. This method is very satisfactory if the object being drawn is solid or if its interior parts are very simple. But, if the interior of an object is complicated or if the component parts of the machine are drawn assembled, an attempt to show hidden portions by commonly used hidden lines will result in a very confusing drawing which is difficult to draw and almost impossible to read.

A common example would be an apple. We all know that inside the apple is a core, seeds, and maybe a worm; but how many there are, where they are located, and the size of each of these inside components are impossible to see from the outside of the apple. If the apple is cut in half or in quarters we can easily see the make-up of the apple's interior.

On the next page is an illustration showing the clarity that a section view can make. The object is shown first in an isometric view and then in a typical three-view orthographic drawing. Notice how complicated the hidden lines become even in a simple object like this. In the third illustration is an isometric with an imaginary cutting plane drawn through the center of the object. If the portion of the object closest to us was removed at the cutting plane the remainder would be considered to be in full section. In illustration (4) is an orthographic projection with the front view in full section. It is quite obvious how much clearer the sectioned orthographic drawing is than the one with sections deleted (2).

It should be noted that the arrows at the end of the cutting plane line always point away from the adjacent view showing the section area. In other words, the portion of the object behind the arrows is removed, exposing the internal portions of the object for the sectioned view adjacent to it.

A half section is another commonly used type of section drawing. Because of its make-up it is generally used on circular or symmetrical type drawings. In illustration (5) are a front and a side view of a pulley wheel. In illustration (6) is the same object shown with half of a conventional front view and the other half in section. This type of drawing gives the observer a much clearer picture of what the object really looks like inside. Notice how the cutting plane line is shown. There is an arrow only on one end, indicating that the point of view is in line with the center line (horizontal) looking towards the center of the object and away from the adjacent view.

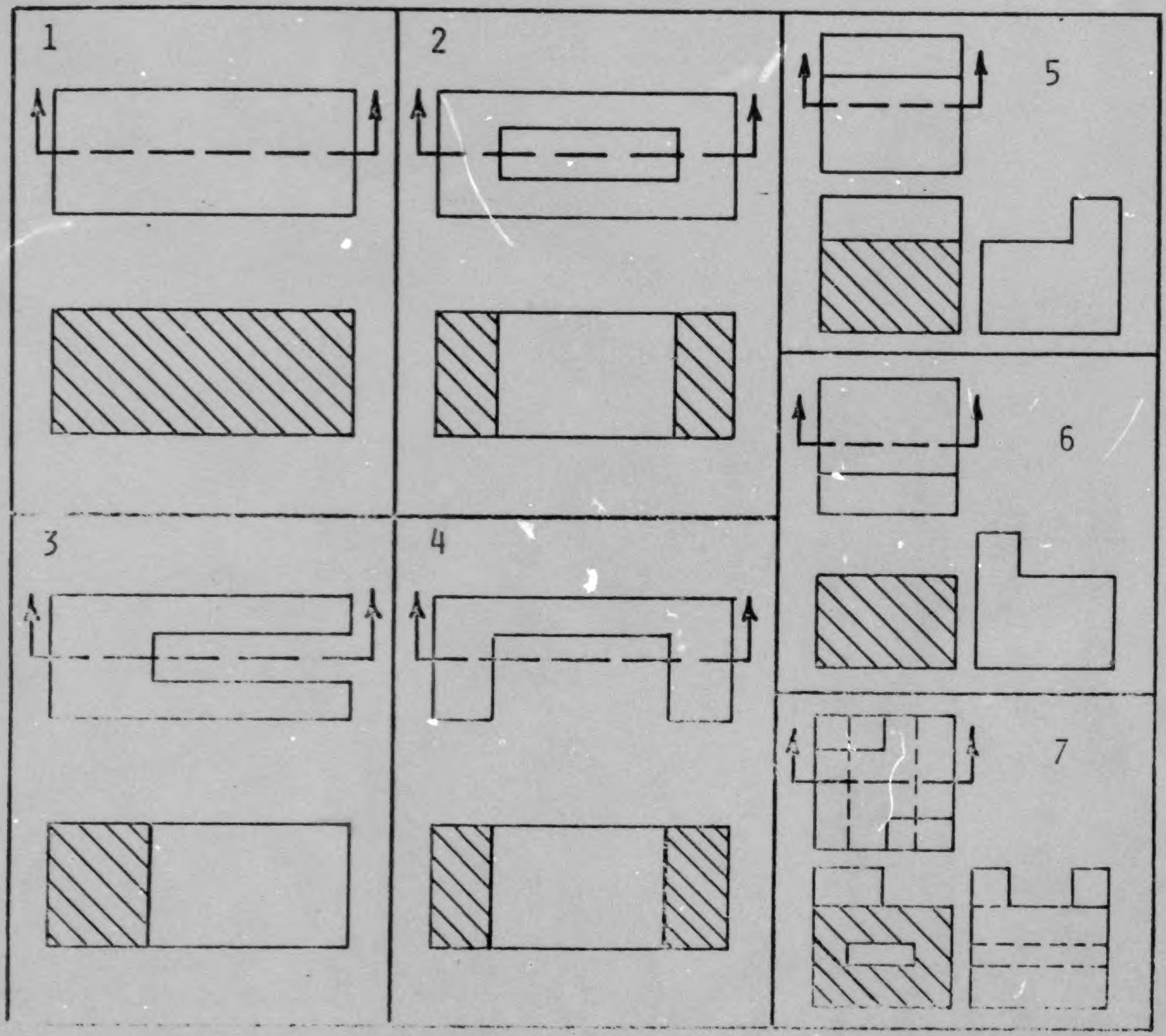
There are several other types of section views which include broken-out sections, rotated sections, removed sections, auxiliary sections, assembly sections, offset sections, and thin sections. These, however, are beyond the scope of this lesson and will not be discussed until the first course of drafting.

Thus far, in the illustrations of this lesson you will notice that the sectioned areas are crosshatched, commonly called section lining. These thin lines are often drawn across the cut area at a 45 degree angle with the horizontal. If the object consists of two parts as in an assembly drawing, the lining runs in opposite directions to show contrast. If there are three or more parts in the section area, then other angles are used to show contrast. In using lining of this nature it is almost impossible to know the type of material used in the object. A note somewhere on the drawing will then be required to relate this information to the observer. The spacing of the section lining should be such as will give the effect of an even tint. For most purposes the distance between the lines should be about 1/16" to 1/8" apart, although this will vary with the size and complexity of the object drawn. In sketching, spacing should be done by the eye only. When drafting tools are used, your instructor will show you several ways it can be done neatly and accurately. Uneven spacing not only will ruin the appearance of a drawing, but will also make it much harder to read. Below are four illustrations of section lining. The first is considered the correct method, while the other three are incorrect and unpleasant to the eye.

Many materials have standard symbols which can be drawn on the sectioned drawing; in this way an informed observer can quickly see what types of materials the object consists of. Following are examples of fifteen symbols of different materials, there are many more but these are the common ones.

To make any section view, think of how the object would look if a portion of it were actually removed. Draw all the section lines that are in the plane of the section and all visible edges back of the plane. Do not draw any hidden lines unless they are required to better describe the shape of the object.

Below are some sections to study. They are all done correctly. Do you understand all of them? If not, ask the instructor for further explanation.



WORKSHEET - SECTIONING #1

General Instructions - Below are rectangles with the name of a material lettered below each rectangle. Show the correct section symbol for the material indicated by sketching within the rectangle the standard symbol found in the reading of this lesson.

TRANSPARENT MATERIALS

CONCRETE

BRASS

INSULATION

STEEL

FIREBRICK

PLASTIC

WOOD

ALUMINUM

SAND

WATER

LEAD

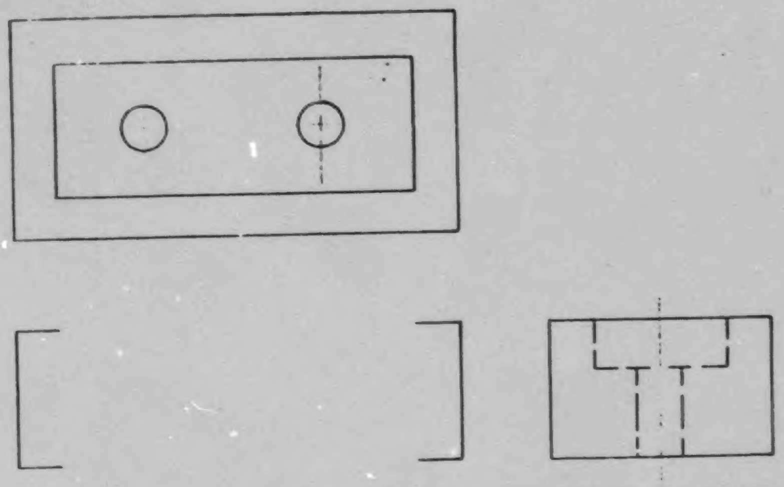
EARTH

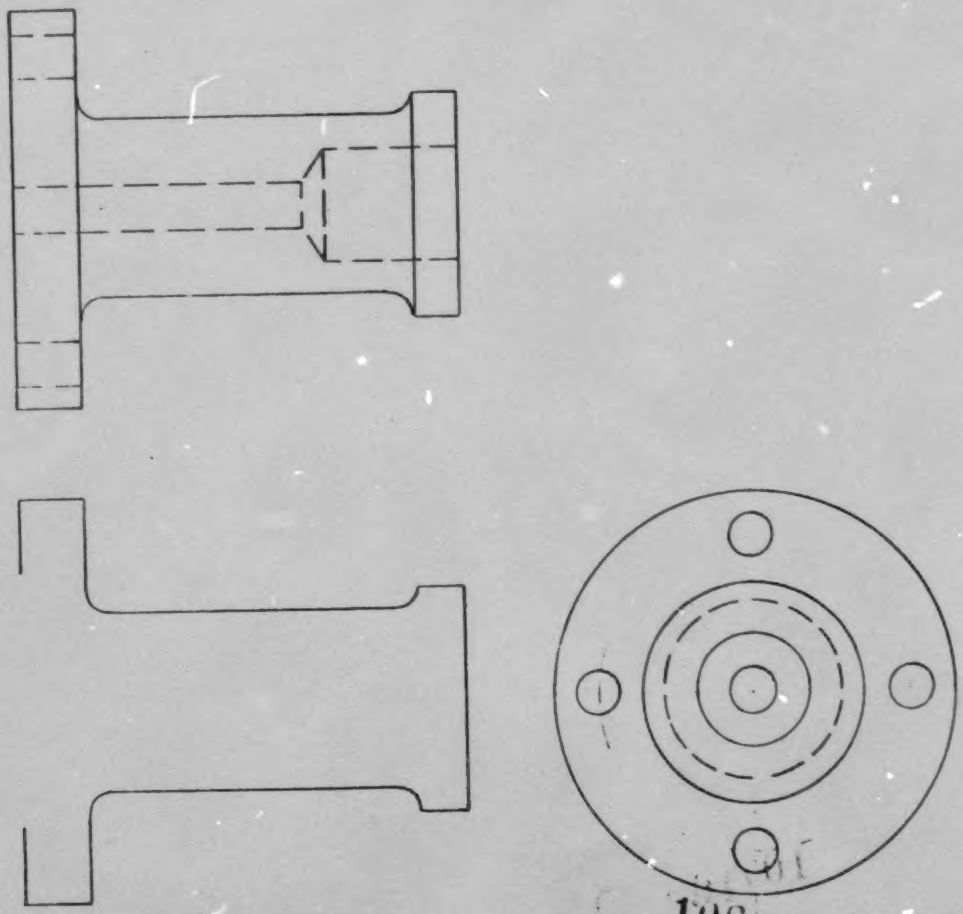
CAST IRON

MARBLE

WORKSHEET - SECTIONING #2

General Instructions - In both problems of this worksheet, sketch a full section of the object in the front view. Show the cutting plane line with arrows facing the correct direction. Indicate on the sectioned view that the object at the top of the work sheet is made of steel, and the object on the bottom is made of cast iron.





TYPES OF PICTORAL DRAWINGS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of pictorial drawings, to include the types of pictorial drawings, and drawing techniques.

UNIT OUTLINE:

1. Types of pictorials
    - A. Oblique
    - B. Isometric
    - C. Perspective
2. Oblique
    - A. Cavalier oblique
    - B. Cabinet oblique
    - C. General oblique
3. Isometric
    - A. Cube method
    - B. Surfaces on an isometric
    - C. Positioning and centering
    - D. Drawing angles
    - E. Drawing curves
    - F. Drawing circles
    - G. Dimensioning

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Demonstrate correct procedures for drawing obliques and isometrics.
4. Attend classroom discussions covering pictorial drawing practices.

STUDENT ACTIVITIES:

1. Participate in lecture discussions covering pictorial drawing procedures.

2. Demonstrate the ability to produce different types of pictorial drawings.

3. Complete assigned exercises designed to enhance student proficiency in developing pictorial drawings.

Oblique Sketching

You have read that a pictorial drawing is a drawing somewhat like a photograph which helps to interpret a drawing. You have discoverd that an isometric is the most commonly used pictorial drawing. In this unit you will study that oblique drawings are also widely used as aids. There are several types of oblique drawings; cabinet, cavalier, and general oblique are three types. All are based on the same principle and are drawn in about the same manner. All angles are less than 90 degrees from the vertical axis.

Before discussing the different types of obliques, let us first explain what an oblique drawing is. An oblique is a drawing where the front face of the object is drawn on a horizontal axis and all measurements of the front face are true. All other lines are drawn at less than 90 degrees.

Example

CAVALIER OBLIQUE

As in all oblique drawings, the front view remains true shape. the only distinction between oblique drawings is the angle of projection and the depth of the object. Cavalier oblique is a drawing in which the front view remains true and the angle of projection is placed at 30 degrees, 45 degrees, or 60b degrees. The scale on the receding axis is full. The cavalier oblique is the most common type of oblique drawing (refer to Figure 1, next page).

Drawing an Oblique Cavalier

CABINET (OBLIQUE) DRAWINGS

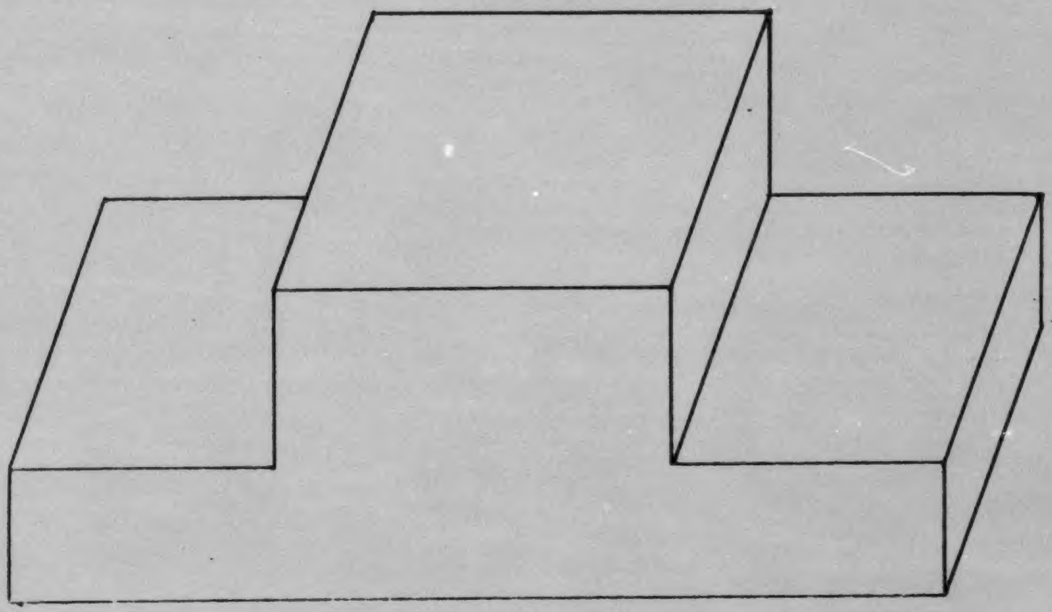
You will discover after drawing a cavalier drawing that some objects look out of proportion. The sides will apear too long. To solve this we will use the second form of oblique drawing called cabinet.

Cabinet drawings are similar to cavalier drawings except that the depth of the object is cut in half in a cabinet drawing. When the depth is cut in half the object will appear less distorted. The depth axis can be placed at any angle, but the two most commonly used angles are 30 degrees and 45 degrees (refer to Figure 2, following Figure 1 next page).

How to Draw an Oblique

THE GENERAL OBLIQUE

The general oblique can be drawn at any angle less than 90 degrees, but the depth must be from 1/2 to full depth. The value of a general oblique drawing is that by changing the angle and the depth, the object may always appear to be in proportion.

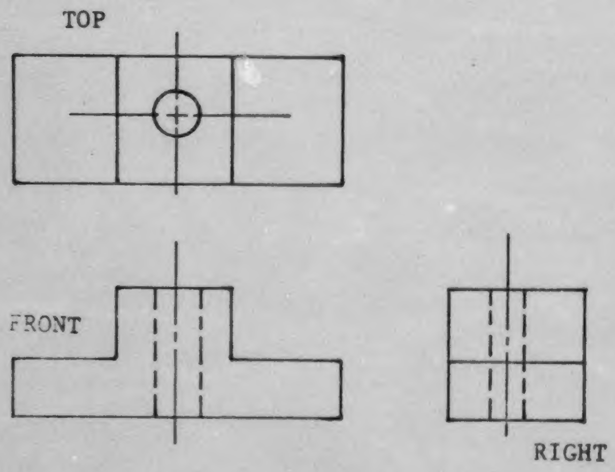


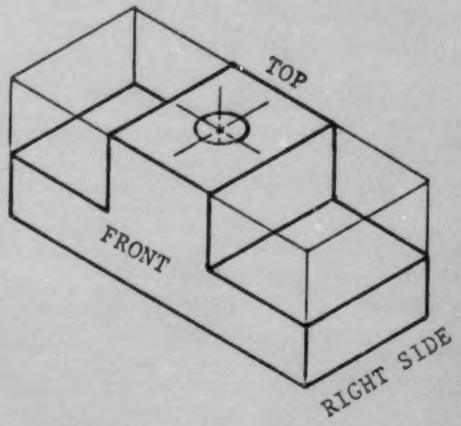
GENERAL OBLIQUE – 70° $\frac{3}{4}$

Isometric Sketching

In the area of technical graphic communicaton it is often necessary to produce drawings for use as illustrations in catalogs and instruction manuals. The type of drawing often used for these purposes is called pictorial. A pictorial drawing is one which resembles a photograph and, as a result, may be easily read by the untrained.

An isometric drawing is one type of pictorial drawing. An isometric is drawn through each of three axes, spaced 120 degrees apart. Length, depth, and width dimensions are laid out along one of these axes. To draw an isometric, we must determine the orientation which best shows the features of the object.





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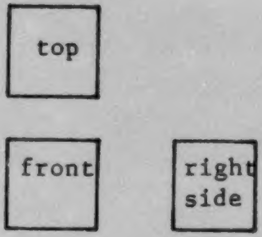
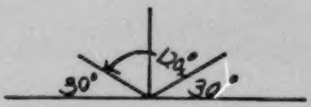
Directions for drawing an isometric using the cube method

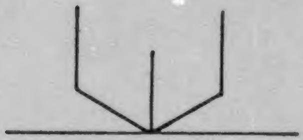
The cube method of laying out an isometric greatly simplifies the drawing process. To use this method, the first step is to draw the three isometric axes. One axis is drawn vertical; the other axes are drawn at an angle of 30 degrees from the horizontal (one right; one left). Along the axis to the left, the overall length is laid off. Along the axis to the right, the total depth of the object is drawn. Along the vertical axis, the total height is laid off.



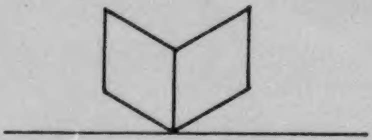
Step 1



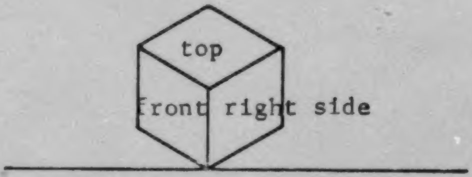
Step 2



Step 3



Step 4



The isometric cube is then completed as shown in Steps 1, 2, 3, and 4 at left. Once the cube is constructed it is a relatively simple process to complete the drawing, by measuring along the edges of the cube to locate individual features.

Nonisometric lines

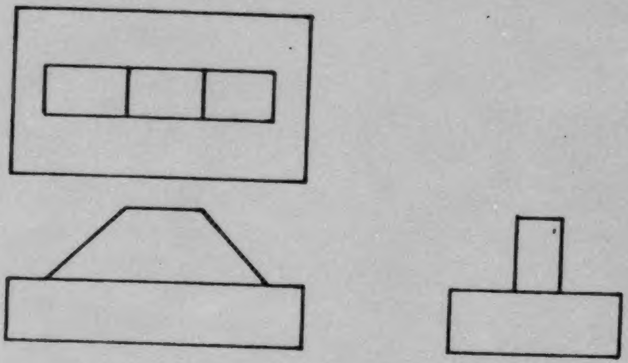
Many isometric drawings will have lines which are not parallel to any of the axes; these lines are called nonisometric lines. These lines are not true length and must be plotted in by points.

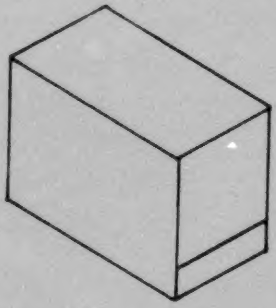
Steps in drawing nonisometric lines

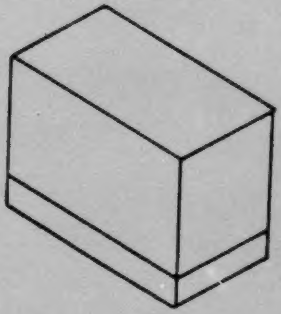
We will use the orthographic drawing below as an example of non-isometric lines.

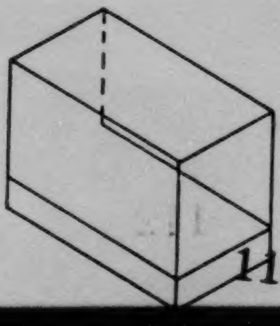
Step 1: Draw the isometric cube, using the measurements of the overall width, depth, and height.

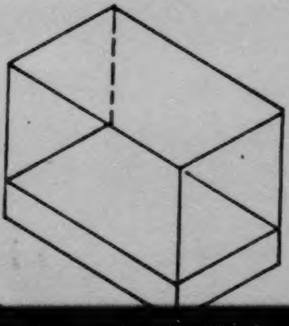
Step 2: Draw in all lines that fall parallel with the axis, looking at the front and right side in the above orthographic drawing.



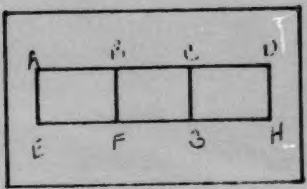


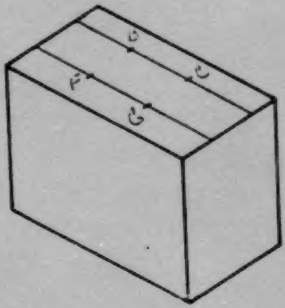


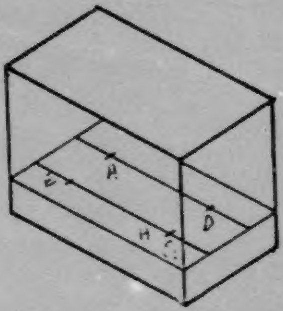




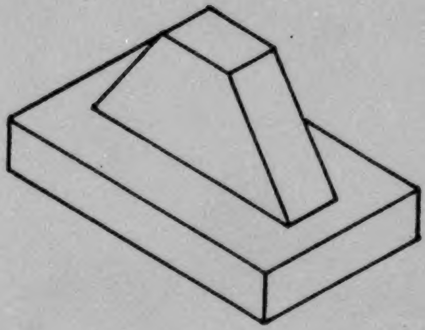
Step 3: Looking at the top view, you will now take off measurements from this view and place the points on the top of the isometric cube.



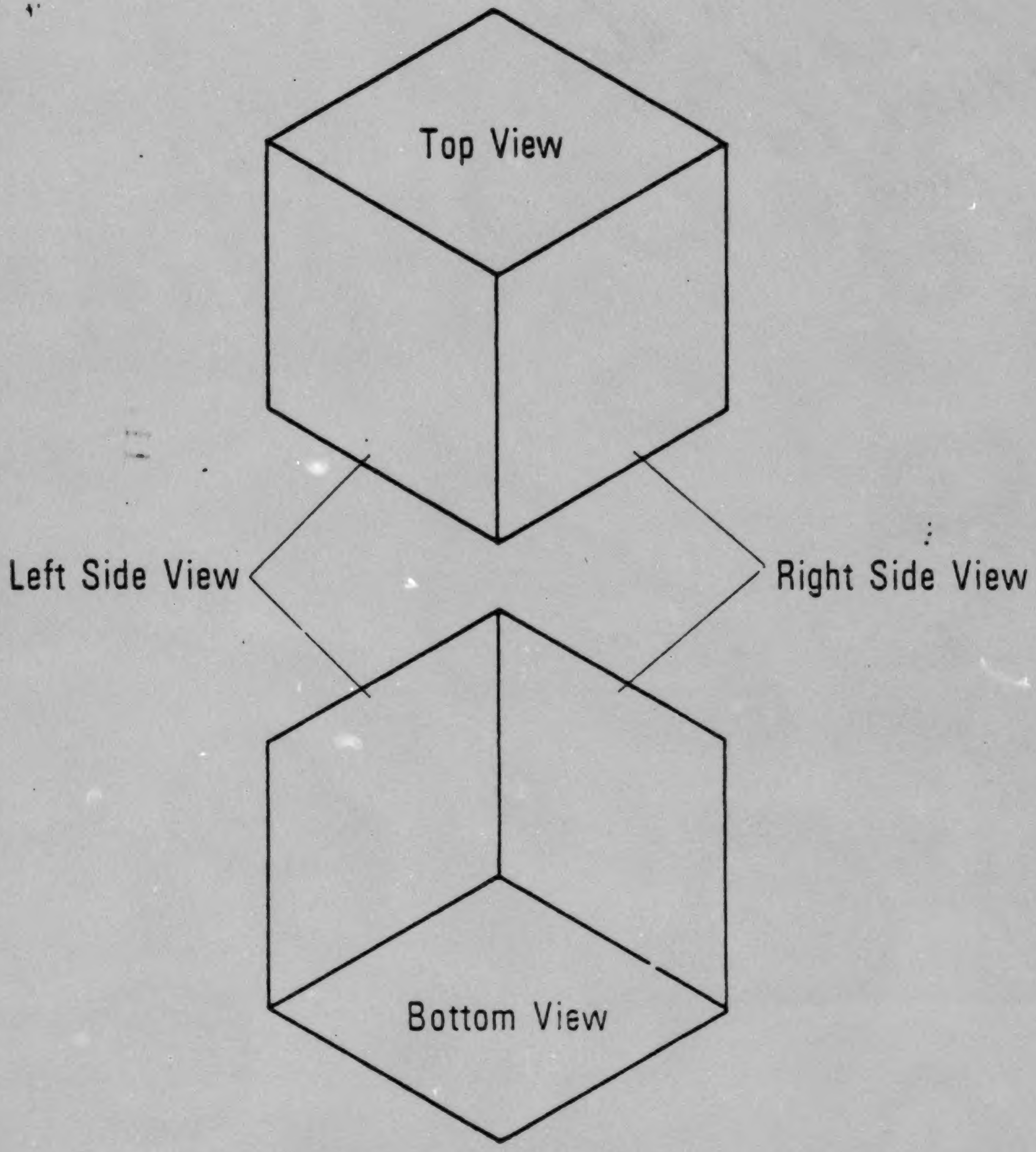




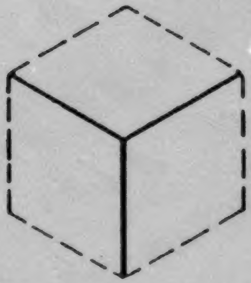
Step 4: Draw in all other lines needed to finish the drawing, and erase all unnecessary lines.



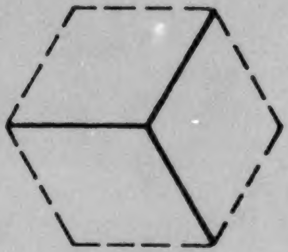
Surfaces on an Isometric


Top View
Left Side View
Right Side View
Bottom View

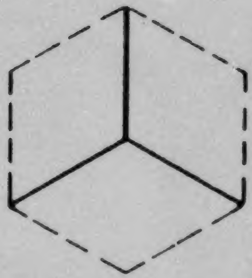
Positions of Isometric Axis Lines



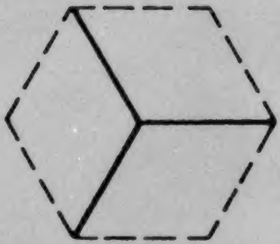
Top



Right Side

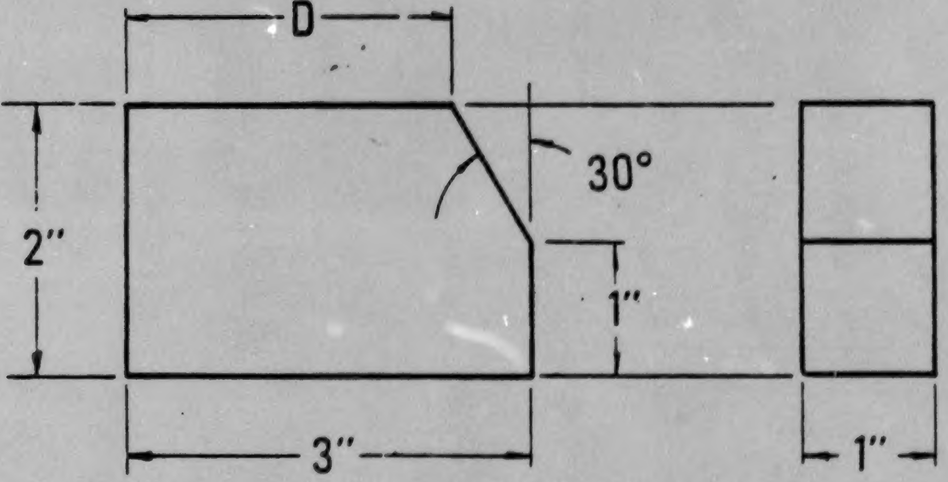


Bottom

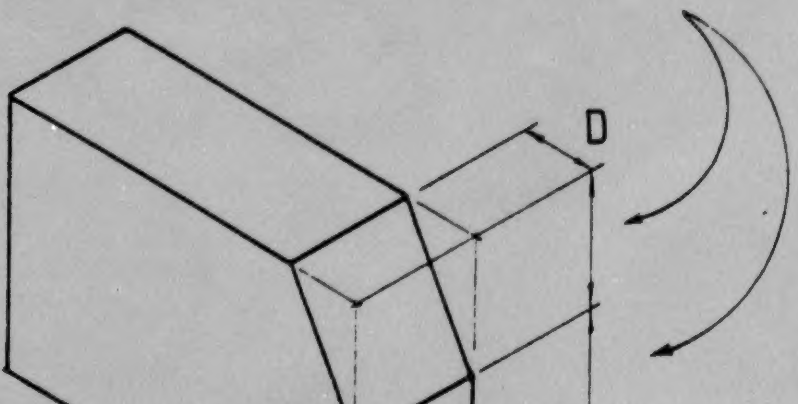


Left Side

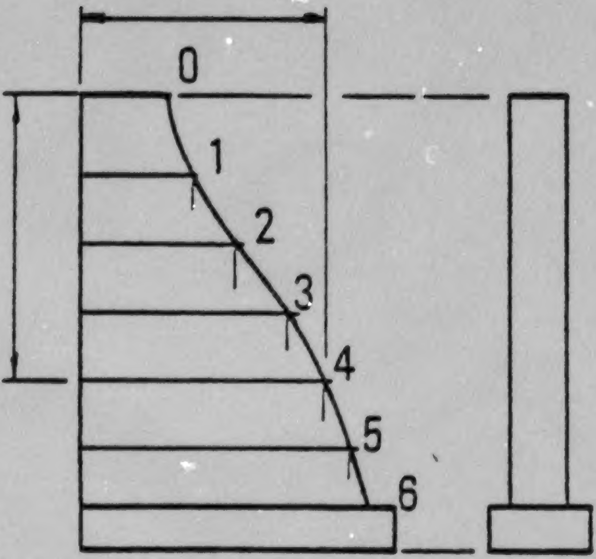
Angles in Isometric



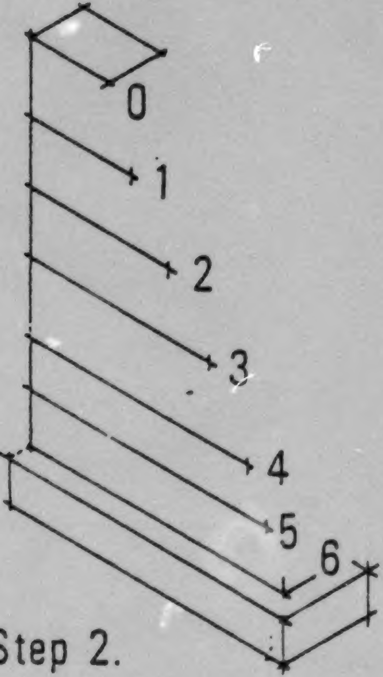
Either dimension could be used to locate edge shown.



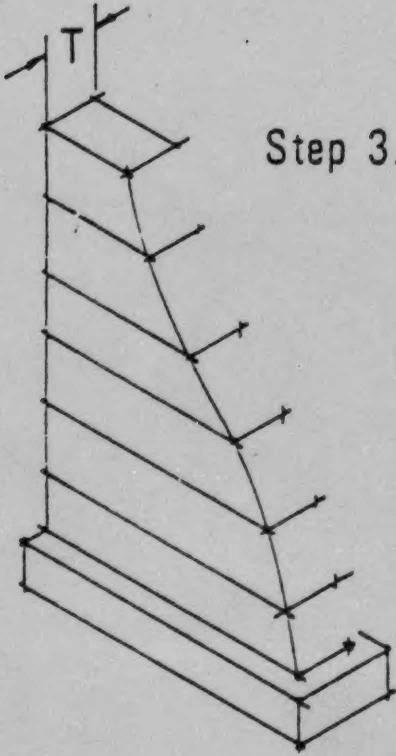
Curves in Isometric



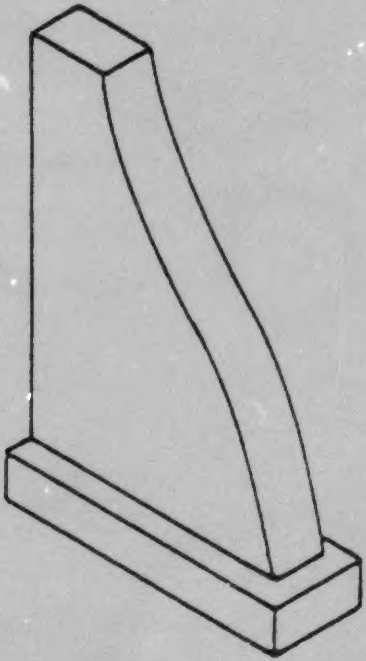
Step 1.



Step 2.

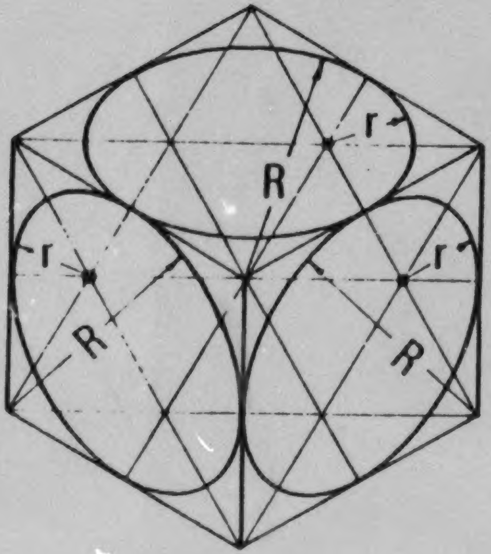


Step 3.



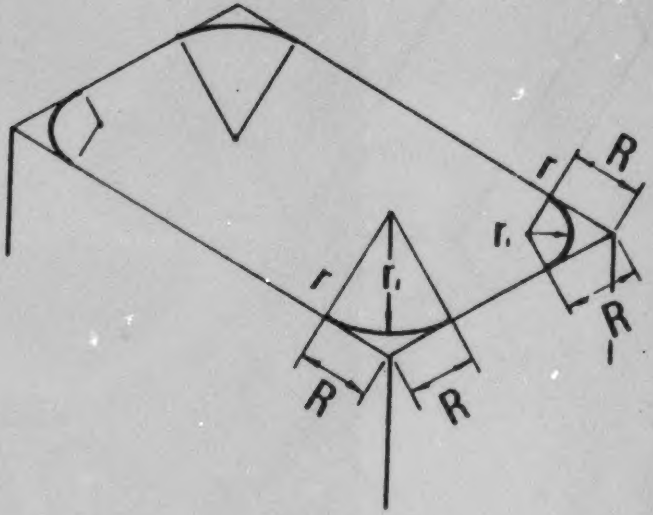
Step 4.

Isometric Circles

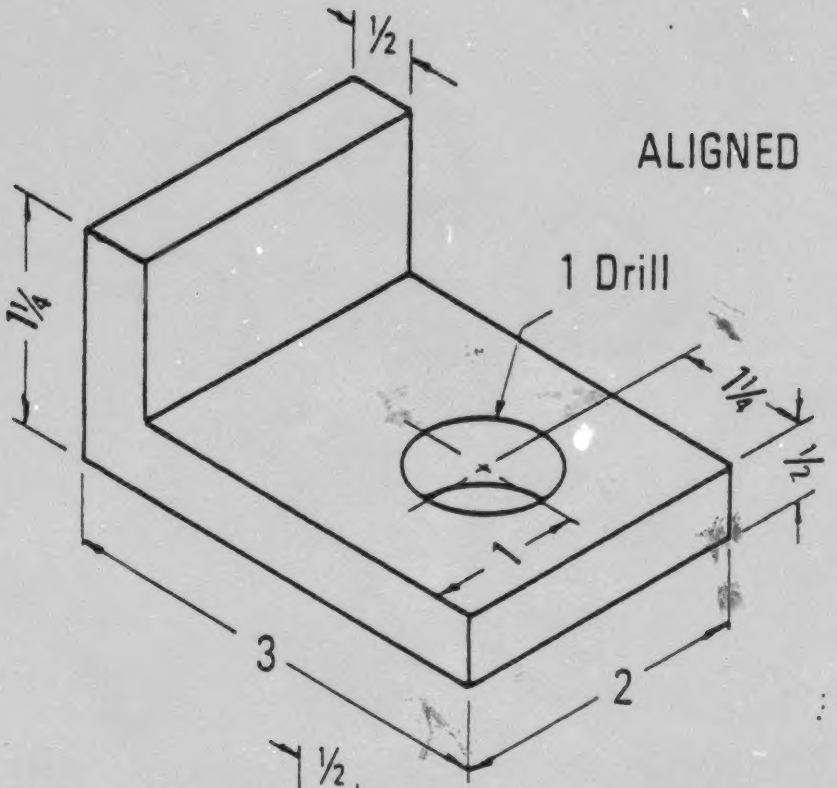


CIRCLES

ARCS

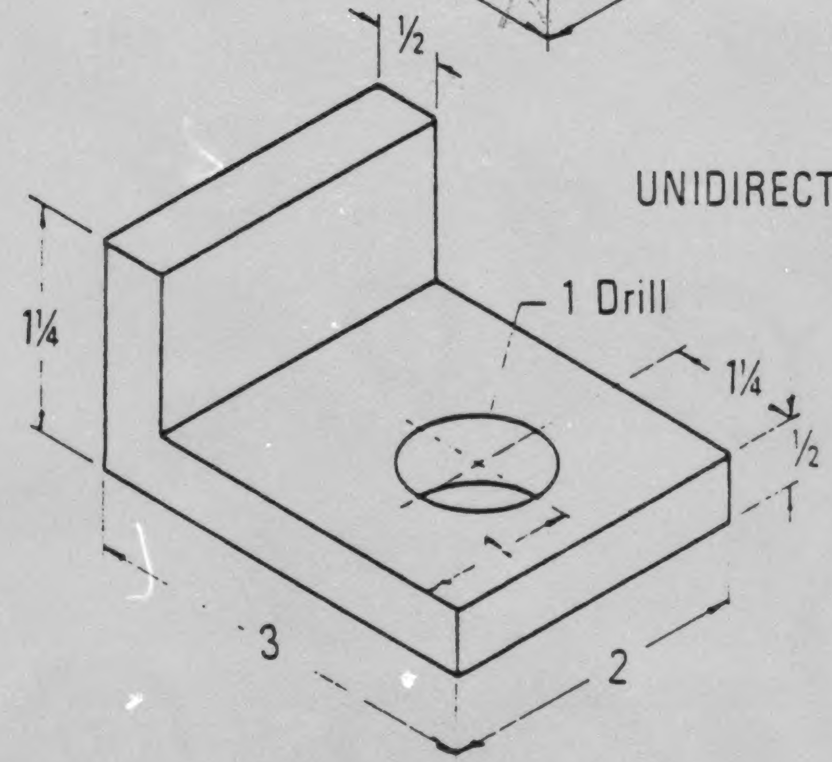


Systems of Dimensioning Isometric



ALIGNED

½
1¼
1 Drill
1¼
½
1
3
2



UNIDIRECTIONAL

½
1¼
1 Drill
1¼
½
1
3
2

DRAFTING CAREERS

UNIT OBJECTIVES:

Upon completion of this unit, the students will possess basic knowledge of career opportunities available in the drafting field, and be aware of job opportunities available within their local communities.

CONTENT OUTLINE:

1. Career opportunities

2. Community industries using drafting

3. Community job opportunities

TEACHER ACTIVITIES:

1. Make transparencies.

2. Present information relative to the content outline.

3. Prepare handout materials listing the type of drafting positions available and a brief job description for each job.

4. Arrange a field trip to a local industry which employes draftsmen.

5. Arrange for a guest speaker.

6. Attend classroom discussions covering career opportunities in the drafting field.

STUDENT ACTIVITIES:

1. Participate in lecture discussions concerning career opportunities.

2. Develop a file of drafting positions available by canvassing help wanted advertisements in local newspapers.

3. Select one drafting type position and discuss it with fellow class members.

U.S.O.E. Career Cluster:

COMMUNICATIONS

Occupational Family:

DRAFTING

NATURE OF WORK

Drafters prepare detailed drawings based on rough sketches, specification, and calculations made by scientists, engineers, architects, and designers. They also calculate the strength, quality, quantity, and cost of materials. Final drawing contains a detailed view of the object from all sides as well as specifications for materials to be used, procedures followed, and other information to carry out the job. Drafters are classified according to the work they do or their level of responsibility.

In preparing drawings, drafters use compasses, dividers, protractors, triangles, and other drafting devices. They also use engineering handbooks, tables, and calculators to help solve technical problems.

ANALYSIS OF JOB PREREQUISITES

Training for a career in drafting whether in a high school or post-high school program, should include courses in mathematics, physical sciences, mechanical drawing, and drafting. Shop practices and shop skills are also helpful since many higher drafting jobs require knowledge of manufacturing or construction methods.

Those planning careers in drafting should be able to do freehand drawings of three-dimensional objects and also detailed work requiring a high degree of accuracy. They should also have good eyesight and manual dexterity. In addition, they should be able to function as part of a team since they work directly with engineers, architects, and skilled workers. Artistic ability is helpful in specialized fields.

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ANALYSIS OF JOB ATTRIBUTES

Prospective drafters can acquire the necessary training in technical institutes, junior and community colleges, extension divisions of universities, and vocational and technical high schools. Some persons receive training and experience in the Armed Forces. Others qualify through on-the-job training programs combined with part-time school or three to four years apprenticeship programs. Many technical schools offer courses in structural design, architectural drawing, and engineering or industrial technology.

High school graduates usually start as tracers. Those having post high school technical training may begin as junior drafters. After gaining experience, they may advance to checkers, detailers, senior drafter, or supervisors. Courses in engineering and mathematics sometimes enable drafters to transfer to engineering positions.

Employment of drafters, both male and female, is expected to increase faster than the average for all occupations. This growth along with the need to replace those who die, retire, or move into other fields of work, should provide favorable job opportunities through the mid-1980's.

Although drafters usually work in well-lighted and well-ventilated rooms, they often must sit for long periods of time doing detailed work. Occasionally, drafters may visit other offices or construction sites to gain first-hand information about a certain assignment.

In private industry, tracers averaged about $8,400 a year in 1976, while more experienced drafters averaged between $9,800 and $12,000 a year. In 1977 the Federal Government paid drafters having an associate degree starting salaries of $8,316 a year. Those with less education or experience generally started at $7,408. The average Federal Government salary for all drafters was about $11,000 a year. Refer to the latest edition of Occupational Outlook Handbook for recent salaries.

JOB TITLES

Job titles in this occupational family are:

Title	D.O.T.
Aeronautical Drafter	002.261.010
Architectural Drafter	001.261.010
Automotive Design Drafter	017.281.026
Civil Drafter	005.281.010
Commercial Drafter	017.261.026
Directional Survery Drafter	010.281.010
Electrical Drafter	003.281.010
Electronic Drafter	003.281.014
Electromechanisms Design Drafter	017.261.014
Geological Drafter	010.281.014
Geophysical Drafter	010.281.018
Heating and Ventilating Drafter	017.261.034

Landscape Drafter	001.261.014
Mechanical Drafter	007.281.010
Oil and Gas Drafter	017.281.030
Plumbing Drafter	017.261.038
Structural Drafter	005.281.014
Tool Design Drafter	007.261.022
Topographical Drafter	018.261.014
Assistant Drafter	017.281.018

COMMUNICATIONS

JOB STRUCTURE: DRAFTING

JOB TITLE: Drafter
D.O.T. No.:

Major Job Function:

Prepares clear, complete and accurate working plans and detail drawings from rough or detailed sketches or notes for engineering or manufacturing purposes, according to specified dimensions.

Job Duties:

1. Makes final sketch of proposed drawing, checking dimension of parts, materials to be used, relation of one part to another, and relation of various parts to whole structure or project.

2. Makes any adjustments or changes necessary or desired.

3. Inks in lines and letters on pencil drawing as required.

4. Exercises manual skill in manipulation of triangles, T-square, and other drawing tools.

5. Draws charts for representation of statistical data.

6. Draws finished designs from sketches.

7. Utilizes knowledge of various machines, engineering practices, mathematics, building materials, and other physical sciences to complete drawings. CLASSIFICATIONS ARE MADE ACCORDING TO TYPE OF DRAFTING.

JOB TITLE: Aeronautical Drafter
D.O.T. No.: 002.261.010

Major Job Functions:

Performs duties of Drafter specializing in drafting engineering drawings of developmental or production airplanes and missiles, ancillary equipment, including launch mechanisms and scale models of prototype aircraft, as planned by Aeronautical Engineer.

JOB TITLE: Architectural Drafter
D.O.T. No.: 001.261.010

Major Job Function:

Performs duties of DRAFTER by drawing artistic and structural features of any class of buildings and like structures.

Job Duties:

1. Delineates designs and details, using drawing instruments.

2. Confirms compliance with building codes.

3. May specialize in planning architectural details according to structural materials used as Drafter, Tile and Marble.

JOB TITLE: Landscape Drafter
D.O.T. No.: 001.261.014

Major Job Function:

Preparesdetailed scale drawings and tracings from rough sketches or other data provided by Landscape Architect performing duties described under Drafter.

Job Duties:

1. May prepare separate detailed site plan, grading and drainage plan, lighting plan, paving plan, irrigation plan, planting plan, and drawings and detail of garden structures.

2. May build models of proposed landscape construction and prepare colored drawings for presentation to client.

JOB TITLE: Electrical Drafter
D.O.T. No.: 003.281.010

Major Job Function:

Drafts electrical equipment working drawings and wiring diagrams used by construction crews and repairmen who erect, install, and repair electrical equipment and wiring in communications centers, power plants, industrial establishments, commercial or domestic buildings, or electrical distributions systems, performing duties as described under Drafter.

JOB TITLE: Electronic Drafter
D.O.T. No.: 003.281.014

Major Job Function:

Drafts wiring diagrams, schematics, and layout drawings used in manufacture, assembly installation, and repair of electronic equipment, such as television cameras, radio transmitters and receivers, audioamplifiers, computers, and radiation deflectors, performing duties as described under Drafter.

Job Duties:

1. Drafts layout and detail drawings of racks, panels, and enclosures.

2. May conduct service and interference studies and prepare maps and charts related to radio and television surveys.

JOB TITLE: Civil Drafter
D.O.T. No.: 005.281.010

Major Job Function:

Drafts detailed construction drawings, topographical profiles, and related maps and specification sheets used in planning and construction of highways, river and harbor improvements, floor control, drainage, and other civil engineering projects, performing duties as described under Drafter.

Job Duties:

1. Plots maps and charts showing profiles and cross-sections, indicating relation of topographical contours and elevations to buildings, retaining walls,tunnels, overhead powerlines, and other structures.

2. Drafts detailed drawings of structures and installations such as roads, culverts, fresh water supply and sewage disposal systems, dikes, wharfs, and breakwaters.

3. Computes volume of tonnage of excavations and fills and prepares graphs and hauling diagrams used in earthmoving operations.

JOB TITLE: Structural Drafter
D.O.T. No.: 005.281.014

Major Job Functions:

Performs duties by Drafter by drawing plans and details for structures employing structural reinforcing steel, concrete, masonry, wood and other structural materials.

Job Duties:

1. Produces plans and details of foundations, building frame, floor and roof framing and other structural elements.

JOB TITLE: Tool-Drawing Checker
D.O.T. No.: 007.167.022

Major Job Function:

Examines airplane tool drawings made by Tool Designer for inaccuracies of detail and to determine production feasibility of designs.

Job Duties:

1. Visually compares design of jig, fixture, or tool with drawing of airplane parts, matching coordinating points for accuracy of fit.

2. Examines drawing details, such as dimensions, angles, allowances, and shop notes for errors, guided by specifications on engineering drawing and knowledge of mathematics and drafting.

3. Verifies size and quantity of materials and methods of fabrication.

4. Notes corrections on drawings in pencil or ink.

JOB TITLE: Chief Drafter
D.O.T. No.: 007.261.010

Major Job Function:

Draws rough layout and sketches, and assigns work to and directs subordinate drafting workers.

Job Duties:

1. Sketches layout according to design proposal and standard specifications and practices.

2. Assigns drafting of detail drawings to subordinate personnel and verifies accuracy and completeness of finished drawings.

3. May perform duties described under Drafter.

JOB TITLE: Tool Design Drafter
D.O.T. No.: 007.261.022

Major Job Function:

Drafts detailed drawing plans for manufacture of tools, usually following designs and specifications indicated by Tool Designer.

Job Duties:

1. Performs duties as described under Drafter.

JOB TITLE: Directional Survey Drafter
D.O.T. No.: 010.281.010

Major Job Function:

Plots oil or gas-well boreholes from photographic subsurface survey recordings and other data.

Job Duties:

1. Computes and represents diameter, depth, degree, and direction of inclination, location and equipment, and other dimensions and characteristics of borehole.

2. Performs other duties as described under Drafter.

JOB TITLE: Geological Drafter
D.O.T. No.: 010.281.014

Major Job Function:

Draws maps, diagrams, profiles, cross sections, directional surveys, and subsurface formations to represent geological and geophysical stratigraphy and locations of gas and oil deposits, performing duties as described under Drafter.

Job Duties:

1. Correlates and interprets data obtained from topographical surveys, well logs or geophysical prospecting reports, utilizing special symbols to denote geological and geophysical formations or oilfield installations.

2. May finish drawings in mediums and accordint to specifications required for reproduction by blueprinting, photographing, or other duplication methods.

JOB TITLE: Geophysical Drafter
D.O.T. No.: 010.281.018

Major Job Function:

Draws subsurface contours in rock formations from data obtained by geophysical prospecting party.

Job Duties:

1. Plots maps and diagrams from computations based on recordings of seismograph, gravity meter, magnetometer, and other petroleum prospecting instruments and from prospecting and surveying field notes.

2. Performs other duties as described under Drafter.

JOB TITLE: Electromechanisms Design Drafter
D.O.T. No.: 017.261.014

Major Job Function:

Drafts designs and electromechanical equipment such as aircraft engines, subassemblies, electronic optical-character-recognition and related data processing systems, gyroscopes, rocket engine control systems, automatic materials handling and processing machinery, or bio-medical equipment.

Job Duties:

1. Confers with engineers and other drafters to interpret design concepts, determine nature and type of required detail working drawings, and coordinate work with others.

2. Drafts details and assembly drawings performing duties described under Drafter.

JOB TITLE: Detailer
D.O.T. No.: 017.261.018

Major Job Function:

Drafts detailed drawings of parts of machines or structures from rough or general design drawings.

Job Duties:

1. Shows dimensions, materials to be used, and other information necessary to make detailed drawings clear and complete.

2. Makes tracings of finished drawing on semitransparent paper from which blueprints can be made.

3. Performs other duties as described under Drafter.

JOB TITLE: Commercial Drafter
D.O.T. No.: 017.261.026

Major Job Function:

Performs duties of Drafter in all-round drafting, such as laying out location of buildings,, planning of arrangements in offices, large rooms, store buildings, and factories, and drawing of charts, forms, and records.

Job Duties:

1. Paints and washes colored drawings when required.

JOB TITLE: Heating and Ventilating Drafter
D.O.T. No.: 017.261.034

Major Job Function:

Performs duties of Drafter, but specialized in drawing plans of installation of heating, air-conditioning, and ventilating equipment.

Job Duties:

1. May calculate heat loss and heat gain for buildings for use in determining equipment specifications, using slide rule and following standard procedures.

2. May specialize in drawing plans for installation of refrigeration equipment as Refrigeration Drafter.

JOB TITLE: Plumbing Drafter
D.O.T. No.: 017.261.038

Major Job Function:

Performs duties of Drafter but specializes in drawing of plans for installation of plumbing equipment.

JOB TITLE: Assistant Drafter
D.O.T. No.: 017.281.018

Major Job Function:

Copies plans and drawings prepared by Drafter tracing them with ink and pencil on transparent paper or cloth spread over drawings, using triangle, T-Square, compass, pens, and other drafting instruments.

Job Duties:

1. Makes simple sketches or drawings under close supervision.

JOB TITLE: Automotive Design Lay-Out Drafter
D.O.T. No.: 017.281.026

Major Job Function:

Prepares working layouts and master drawings of automotive vehicle components, assemblies or systems from specifications, prior layouts, well-defined sketches, models for detailing, applying knowledge of drafting techniques and procedures, automotive vehicle design, manufacturing processes and limitations, using drafting instruments and work aids.

Job Duties:

1. Studies specifications, sketches, notes and other design data and measures prior layouts, using scales and dividers, to determine details and dimensions of components being layed out from the suprimposed views and sections of parts on layouts.

2. Develops design of details not completely defined.

3. Projects sections and auxiliary views of components on layouts.

4. May direct activities of detailers.

JOB TITLE: Oil and Gas Drafter
D.O.T. No.: 017.281.030

Major Job Function:

Drafts plans and drawings for layout, construction, and operation of oil fields, refineries, and pipeline systems from field notes, rough or detailed sketches, and specifications.

Job Duties:

1. Develops detail drawings for construction of equipment and structures, such as drilling derricks, compressor stations, gasoline plants, frame, steel, and masonry buildings, piping manifolds and pipeline systems, and for manufacture, fabrication, and assembly of machines and machine parts.

2. Prepares maps of pipeline systems and oil and gas locations, using field survey notes and aerial photographs.

JOB TITLE: Land Surveyor
D.O.T. No.: 018.167.018

Major Job Function:

Plans, organizes, and directs work of one or more survey parties engaged in surveying earth's surface to determine precise location and measurements of points, elevations, lines, areas, and contours for construction, mapmaking, land division, titles, mining or other purposes.

Job Duties:

1. Researches previous survey evidence, maps, deeds, physical evidence, and other records to obtain data needed for surveys.

2. Develops new data from photogrammetric records.

3. Determines methods and procedures for establishing or re-establishing survey control.

4. Keeps accurate notes, records and sketches to describe and certify work performed.

5. Coordintes findings with work of engineering and architectural personnel, clientss, and other concerned with project.

6. Assumes legal responsibility for work and is licensed by State.

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JOB TITLE: Topographical Drafter
D.O.T. No.: 018.261.014

Major Job Function:

Draws and corrects topographical maps from source data, such as surveying notes, aerial photographs, or other maps.

Job Duties:

1. Performs other duties as described under Drafter.

2. May accompany survey crew in field to compile original survey data or establish location of natural or constructed landmarks.

JOB TITLE: Specification Writer
D.O.T. No.: 019.267.010

Major Job Function:

Interprets architectural or engineering plans and prepares material lists and specifications to be used as standards by plant employees or contracting personnel in material processing or in manufacturing or construction activities.

Job Duties:

1. Analyzes plans and diagrams, or observes and makes notes on materials processing, to determine material and material processing specifications, or specification for manufacturing or construction activities.

2. Writes technical descriptions specifying material qualities and properties, utilizing knowledge of material standards, industrial processes, and manufacturing procedures.

3. Workers usually specialize and are designated according to engineering specialization, product, or process.

JOB TITLE: Industrial Arts Teacher
D.O.T. No.: 091.221.010

Major Job Function:

Teaches students basic theory and assists in development of manipulative skills in industrial arts.

Job Duties:

1. Lectures, illustrates, or demonstrates to teach proper use of shop tools and machines, safety practices, and theory as applied to industrial arts.

2. Teachers specialize in one or more areas, such as woodworking or metalworking, electricity, graphic arts, or mechanical drawing.

JOB TITLE: Vocational Training Teacher (Drafting)
D.O.T. No.: 097.227.014

Major Job Function:

Teaches vocational training subjects in specific trades to students in public or private schools or in industrial plants.

Job Duties:

1. Organizes program of practical and technical instruction, involving demonstrations of skills required in trade, and lectures on theory, practices, methods, processes, and terminology.

2. Instructs students in subject areas, such as safety, mathematics, science, drawing, use and maintenance of tools and equipment, and codes or regulations related to trade.

3. Plans and supervises work of students in shop or laboratory.

4. Tests and evaluates achievement of student in technical knowledge.

JOB TITLE: Estimator
D.O.T. No.: 160.267.018

Major Job Function:

Prepares cost estimates for manufacturing of products, construction projects, or services requested to aid management in bidding on or determining price of product or service.

Job Duties:

1. Compiles list of type of materials, tool or fixture, or equipment requirements, utilizing knowledge of products to be manufactured, services to be performed, or type of structure to be built, using blueprints and specifications.

2. Itemizes tools, fixtures, or equipment to be manufactured by company or purchased from outside sources.

3. Computes cost estimates for materials, purchased equipment, subcontracted work, production activities and requirements, and labor.

JOB TITLE: Contractor
D.O.T. No.: 182.167.010

Major Job Function:

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Contracts to perform specified construction work in accordance with architect's plans, blueprints, codes, and other specifications.

Job Duties:

1. Estimates costs of materials, labor, and use of equipment required to fulfill provisions of contract and prepares bids.

2. Confers with clients to negotiate terms of contract.

3. Subcontracts specialized craft work, such as electrical structural steel, concrete, and plumbing.

4. Purchases material for construction.

5. Supervises workers directly or through subordinate supervisors.

6. May be designated according to specialty license or scope of principal activities.

JOB TITLE: Blueprint Trimmer
D.O.T. No.: 920.687.038

Major Job Function:

Cuts blueprints, measures print margins, punches holes in prints, and folds, staples, and labels blueprints for shipment.

Job Duties:

1. Cuts individual print from continuous strip of processed prints, using shears.

2. Verifies dimensions of blueprint margins, using ruler, and cuts off excess, using shears.

3. Punches holes in blueprint, using paper punch, and folds prints.

4. Staples specified number of prints to folded edges of wrapping paper to form bound set.

5. Writes name and address of customer on wrapping.

6. May sort prints according to numerical code and examine blueprints for defects, such as clarity and double image.

JOB TITLE: Blueprinting and Photocopy Supervisor
D.O.T. No.: 979.130.010

Major Job Function:

Supervises and coordinates activities of Blueprinting-Machine

Operator, Photostat Operator, File Clerk and other workers engaged in producing and filing blueprints, vandyke and ozalid prints, and photostats in an industrial plant or commercial photocopy laboratory.

Job Duties:

1. Sets up blueprint and photostat machines.

2. Trains workers in operation of machines.

3. Inspects finished prints for sharpness, density of line, and size.

4. Consults with customers concerning work details, such as size of prints and prices.

JOB TITLE: Blueprint Machine Operator
D.O.T. No.: 979.682.014

Major Job Function:

Operates machine to make copies (blueprints) of printed material, such as documents or drawings.

Job Duties:

1. Examines negative of original for translucency.

2. Selects sensitized paper according to color of line specified and positions original over paper.

3. Moves controls to regulate light intensity and exposure time, according to translucency of original and type of sensitized paper.

4. Slides original and sensitized paper into printer to expose and develop print.

5. Examines finished print for specified color, intensity, and sharpness of line.

6. Pushes button to supply machine with ammonia or manually pours ammonia into printer.

JOB STRUCTURE: DESIGN

JOB TITLE: Architect
D.O.T. No.: 001.061.010

Major Job Function:

Provides professional services in research, development, design, construction, alteration, or repair of real property, such as private residences, office buildings, theaters, public buildings, or factories.

Job Duties:

1. Consults with client to determine functional and spatial requirements and prepares information regarding design, specifications, materials, equipment, estimated costs, and building time.

2. Plans layout of project and integrates engineering elements into unified design.

3. Prepares scale and full size drawings and contract documents for building contracts.

4. Assists client in obtaining bids and awarding construction contracts.

5. Supervises administration and construction contracts and conducts periodic on-site observation of work in progress.

JOB TITLE: Marine Architect
D.O.T. No.: 001.061.014

Major Job Function:

Designs and oversees construction and repair of marine craft and floating structures, such as ships, barges, tugs, dredges, submarines, torpedos, floats, and buoys.

Job Duties:

1. Studies design proposals and specifications to establish basic characteristics of craft, such as size, weight, speed, propulsion, armament, cargo, displacement, draft, crew and passenger complements, and fresh and salt water service.

2. Oversees construction and testing.

3. Designs complete hull and superstructure according to specifications and test data, in conformity with standards of safety, efficiency, and economy.

4. Designs layout of craft interior including cargo space, passenger compartments, ladder wells and elevators.

JOB TITLE: Tool Designer
D.O.T. No.: 007.061.026

Major Job Function:

Designs broaches, milling-machine cutters, drills and other single- or multiple-edged cutting tools, and related jigs, dies, and fixtures for production or experimental use in metalworking machines.

Job Duties:

1. Studies specifictions and confers with engineering and shop personnel to resolve design problems related to material characteristics, dimensional tolerances, service requirements, manufacturing procedures and cost of tools.

2. Applies algebraic and geometric formulas and standard tool engineering data to develop tool configuration.

3. Selects standard items such as bushings and tool bits for incorporation into tool design.

4. Draws preliminary sketches and prepares layout and detail drawings.

5. Modifies tool designs according to trial and production service data to improve tool life or performance.

JOB TITLE: Technical Illustrator
D.O.T. No.: 017.281.034

Major Job Function:

Lays out and draws illustrations for reproduction in reference works, brochures, and technical manuals dealing with assembly, installation, operation, maintenance, and repair of machines, tools and equipment.

Job Duties:

1. Prepares drawings from blueprints, designs, mockups, and photoprints by methods and techniques suited to specified reproduction process or final use, such as blueprint, photo-offset, and projection transparencies, using drafting and optical equipment.

2. Lays out and draws schematic, perspective, orthographic, or oblique-angle views to depict function, relationship, and assembly-sequence of parts and assemblies, such as gears, engines, and instruments.

3. Shades or colors drawing to emphasize details or eliminate undesired background using ink, crayon, airbrush, and overlays.

4. Pastes instructions and comments in position on drawing.

JOB TITLE: Graphic Designer
D.O.T. No.: 141.061.018

Major Job Function:

Designs art and copy layouts for material to be presented by visual communications media, such as books, magazines, newspapers, television, and packaging

Job Duties:

1. Studies illustrations and photographs to plan presentation of material, product, or service.

2. Determines size and arrangement of illustrative material and copy, selects style and size of type, and arranges layout based upon available space, knowledge of layout principles, and esthetic design concepts.

3. Draws sample of finished layout and presents to ART DIRECTOR for approval.

4. Prepares notes and instructions for workers who assemble and prepare final layouts for printing.

5. Reviews final layout and suggests improvements as needed.

JOB TITLE: Interior Design
D.O.T. No.: 142.051.014

Major Job Function:

Plans, designs, and furnishes interior environments of residential, commercial and industrial buildings.

Job Duties:

1. Advises client on interior design factors, such as space planning, layout and utilization of furnishings and equipment, color schemes, and color coordination.

2. Renders design ideas in form of paste ups, drawings, or illustrations, estimates material requirements and costs, and presents design to client for approval.

3. Selects or designs and purchases furnishings, art works, and accessories.

4. May plan and design interior environments for boats, planes, buses, trains and other enclosed spaces.

5. May be designated Interior Decorator.

JOB TITLE: Industrial Designer
D.O.T. No.: 142.061.026

Major Job Function:

Originates and develops ideas to design the form of manufactured products.

Job Duties:

1. Reads publications, attends showings, and consults with engineering, marketing, production and sales representatives to establish design concepts.

2. Evaluates design ideas based on factors such as appealing appearance, design-function relationships, serviceability, materials and methods engineering, application, budget, price, production costs, method of production, market characteristics, and client specifications.

3. Presents design to client or design committee and discusses need for modification and change.

4. Usually specializes in specific product or type of product including, but not limited to hardware, motor vehicle exteriors and interiors, scientific instruments, industrial equipment, luggage, jewelry, houseware, toys, or novelties and is designated accordingly.

GRAPHIC COMMUNICATIONS

GRAPHIC COMMUNICATIONS (Printing)

A. Introduction to graphic communications

   1. Types of graphic communications

   2. Graphic communications industries

   3. Career opportunities

   4. Image transfer processes

      a. Letter press
      b. Lithography
      c. Block printing
      d. Silk screening

B. Posters and Design

   1. Developing a poster

   2. Elements of design

   3. Principles of design

C. Letter Press (Relief Printing)

   1. Hot stamping

   2. Rubber stamping

D. Lithography (Offset Printing)

   1. Principles of lithography

   2. Principles of offset

   3. Material preparation

   4. Typesetting

E. Block Printing (Intaglio/Gravure)

   1. History of block printing

   2. Methods of block printing

   3. Uses for block printing

   4. Equipment requirements

F. Silk Screening

   1. Principles of silk screening

   2. Equipment used for silk screening
   3. Stencil production

G. Career opportunities

INTRODUCTION TO GRAPHIC COMMUNICATIONS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the types of graphic communications available; industries associated with graphic communications; career opportunities available; and image transfer processes commonly found employed in graphic communications.

CONTENT OUTLINE:

1. Types of graphic communication
2. Graphic communications industries
    a. Printing industry
    b. History of printing
    c. Nature and location
3. Career Opportunities
    a. Types of employment
        1. printing
        2. machine maintenance
        3. communications
        4. training requirements
4. Image transfer processes
    a. Letter press
    b. Lithography
    c. Block
    d. Silk screen

TEACHER ACIVITIES:

1. Make transparencies.

2. Present information relative to the content outline.

3. Attend classroom discussioss covering the introduction to graphic communications.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on graphic communications.

2. Develop a list of local businesses and industries involved in graphic communications and collect samples of their products.

3. Participate in required lab activities

TYPES OF GRAPHIC COMMUNICATIONS

Graphic communications is primarily concerned with sight. However, sound, touch and smell are playing an increasingly important role. The key word "graphic" comes from the Greek "graphein," meaning to write. Writing is properly extended in this case to include drawings and paintings. It also includes "drawings produced by light" or photography. ("Photo" means "light" in Greek.)

So now we can say that graphic communications are messages received by the eye. These messages are about ideas, knowledge, and information. They can be in the form of writing, drawing, or photography. They can be reproduced on many types of materials, singly or in unlimited numbers. They can be reproduced immediately and/or on any later occasion.

This means that books, magazines and newspapers are part of graphic communications. Both the writing and the illustrations are included. Can you imagine a world without this type of communication? It means road maps and road signs. It includes the writing and the pictures on boxes, tubes, jars, cans and plastic packages for food, drugs, clothing and almost everything else made. It includes posters for billboards, and many catalogs and leaflets. It also means currency (money), stamps, reproductions of paintings. The list could go on and on. Graphic communictions is everywhere about us.

GRAPHIC ARTS

The graphic arts concern work with printed matter. The printing industry turns out billions of dollars worth of printed materials every year. Printing is done on paper, wood, glass, cloth, rubber, metal, plastic and leather.

Printing can be done by a number of methods, but there are five major printing processes:

1. letterpress
2. gravure
3. screen
4. engraving
5. offset

In any study of the jobs in the printing industry you must take into account the many processes used in making a copy. The printer is considered a skilled person. It takes a large degree of skill to operate modern machines and to make sure no problems come up to delay the printing process. There are a number of processes in printing.

Each one is necessary to the whole. A mistake can cost money.

Publishing is the process of making something public. Books, magazines, and newspapers are printed or published. A number of people with many skills are involved. A lot of people behind the scenes are not recognized. They have a job to do and they do it.

Newspapers use a number of "behind-the-scenes" people. They make sure the newspapers get out on time.

Magazines use highly skilled persons in many jobs. Good color pictures are hard to reproduce thousands of times. Magazines need to be bound. Bindery jobs vary with the type of binding used to hold the magazines together. A closer look at these jobs will follow.

Industries in Graphic Communications

What is the graphic communictions industry, or "industries" as some prefer to call it? First of all, graphic communications is made up of a large number of different but related industries. They produce an enormous variety of totally different products.

Chief among these is the printing, publishing, and packaging industry. In a group of the 20 largest manufacturing industries, printing, publishing and packaging is the largest. It is the seventh largest total payroll. It is eighth largest in total number of employees.

However, a more important fact for students who are selecting a career is this: Printing and publishing is a growth industry. This means that printing and publishing is growing in the amount of business done each year. It also means that it is growing at a higher rate than the country's total production.

In addition to printingand publishing, graphic communications also includes:

1. The paper and paper products industry
2. The packaging industry
3. The coatings industry
4. The printing ink industry
5. The printing machinery manufacturing industry
6. The graphi arts supply industry
7. The production aspects of journalism, public relations and advertising industries
8. The bindery industry
9. The electronics industry
10. The distribution industry
11. The chemical industry
12. The photographi industry

These, then, make up the graphic arts communications industries. These various industries within graphic communications are in the midst of the greatest challenge of the greatest technological revolution. The future in the graphic communications industries is going to be described by one word: change.

Changes in the Graphics Communication Industry

Graphic communications is rapidly moving from craft to science. Computers have been introduced into the setting of type. They can set the type used in an entire newspaper page in just a few minutes. Conventional methods use many hours. Other new type setting machines are being sold today. With these new machines, the setting of type is being measured, per line of type, in microseconds (millionths of a second). New photographic materials and processes are being developed and put on the market every few months.

Words and illustrations may soon be sent by laser beams directly to the surfaces of image carriers. They may be sent by control of the laser beam through a combination of optics and electronics. Laser beams are fine beams of red light. This process is now in an advanced research stage. The market for the end products (magazines, packages, and so forth) of graphic communications has been rising on a geometric scale. In part, this is a result of the rise in population. It is also a result of the great achievement in the United States of providing free public education for everyone.

There are many reasons for the continuing increase in the amount of printed material. But the simple fact of the increase can be easily understood by the observant person.

There are career opportunities in graphic communications at all levels for young men and women of all interests and talents. The graphic communications industries will need in the years ahead persons to operate new machines and to use new techniques and materials.

Now, let us take a closer look at some jobs in the graphic communications industries.

The Printing Industry

Printing is called an art. It is also a leading industry. It is one of our chief means of communication. It is very important in a country in which everyone is expected to read.

In 1970 the printing industry employed over 1 million people in a wide variety of jobs. Most of these jobs were in the printing, publishing and related industries. Some of the jobs were located in government agencies and in private firms. For example, banks and insurance companies do their own printing or hire specialists to do it.

About one-third of all printing employees work in printing craft occupations. These craft occupations will be explained later. Occupations in the printing industries including printing estimator, printing technician, mailer, computer programmer, and computer typist. They also include the usual clerical, administrative, maintenance and sales jobs found in all industries.

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Information Sheet #1

HISTORY OF PRINTING

If we were to divide the last 50,000 years of man's existence into lifetimes of approximately sixty-two years each, there would have been about 800 such lifetimes. Of these 800 lifetimes, 650 were spent in caves. Only during the last seventy lifetimes have we been able to communicate effectively from one lifetime to another with writing. Just think of the stories that Columbus could have written; the Bible could have been written first-hand. The American West and the Indians, cavemen, someone before. We could know many things for being true if there had been written proof. However, only during the last six lifetimes has man seen the printed word. For the last four lifetimes we've been able to measure time with some precision, and only in the last two has anyone, anywhere used an electric motor. It is evident how much progress man has made after the invention of the printed word. Realize that most of the material goods tht we use each day have been accumulating since man began to store up useful printed knowledge. The rat took an "upward" leap with the invention of writing. It took another leap in the 15th centry when Gutenberg invented movable type. At that time it became possible to roduce some 1000 books a year. By 1950 books were produced at a rate of 120,000 per year. By 1960 this went to 1000 books per day. Today the rate accelerates by the minute, giving us immeasurable resources for knowledge.

This very recent and vast accumulation of knowledge led to new duplicating processes which in turn led to new discoveries that are now replacing old familiar processes. There are some inventions already available which are not being used due to cost and the fact that we are not ready to advance so rapidly. We are at the point now where knowledge is doubling about every four years, an almost overwhelming thought for teacher and students to face because it means continual change in subject content and increases still more our dependence on printing--what we now call Graphic Communications.

Today, paper is used for a diverse number of products--books, maps, drawings, magazines, forms, bulletins, reports and others that would take a book to list.

To give the student an idea of the importance and increase in printing, take your students to your library and tell them how long it would have taken to print all of the books before movable type. For instance, before Gutenberg an ordinary person could not buy a book. After Gutenberg, approximately 1000 books a year could be printed.

Information Sheet #2

Chronology of Printing

Scribes (10-20 books a year)	1423
Movable type, Gutenberg	1453
Aniline dye, Shapiro could be used to duplicate handwriting	1880
Carbon paper Stencils - Edison	1880
Electric motor - Edison	
First typewriter, Sholes	1867
Linotype	1884
Stone Lithography, Alois Senefelder	1796
Photography	1839
Zinc Plates	1860
Offset press, Ira Rubel	1906

Nature and Location of the Printing Industry

The printing process is basically a means of transferring ink impressions of words, numerals, symbols, and photographs or other illustrations to paper, metal or other materials. The most commonly used methods of printing are: letterpress, flexography, lithography, gravure, screen printing.

Each of these methods has a special skill associated with it. People must be trained to accomplish a good job each time they work. In 1970 the largest division in terms of employment was newspaper printing and publishing. There were over 370,000 people working in about 8,000 different printing firms. Most daily newspapers in the country print their own paper. They may have up to 2,000 employees. Most weekly and daily newspapers will have less than 20 employees.

Commercial or job printing firms were the second largest printing division. They used about 355,000 people in about 19,000 plants. This particular division produces advertising materials, letterheads, business cards, calendars, catalogs, labels, maps, and pamphlets. They may also print limited quantities of newspapers, books and magazines. More than one-half of those employed in commercial or job printing work in shops with less than 100 employees. There are those exceptions, however, where large firms use over 100 people.

Almost every town in the country has a print shop. Some of them are weekly newspapers, which take on other printing jobs to keep the presses running. More than one-half of the people employed in printing are located in five states: New York, Illinois, California, Pennsylvania, and Ohio. Most of the printing plants are located near cities that have large populations. These are places such as New York City, Chicago, Los Angeles, Philadelphia, San Francisco-Oakland, Cincinnati, and Cleveland. Book and magazine printing are highly concentrated in these areas. There are some other large employment areas for printers.

Types of Employment

1. Printing Occupations

Production of printer materials involves workers in a wide variety of jobs. Printing skilled workers numbered about 400,000 in 1970. They represent a large portion of the printing occupations. They usually specialize in one area of printing operations (for instance, typesetting, photography, platemaking, presswork, or binding). Their training, moreover, is confined largely to only one of the basic printing methods--letterpress, lithography, or gravure.

The largest group of skilled workers are the composing room workers. There were about 185,000 of them in 1970. This group includes hand compositors, typesetting machine operators, makeup people, tape-perforating machine operators.

Other large groups of skilled workers are printing press workers and their asistants, lithographic skilled workers, including camera operators, artists, strippers, platemakers, and lithographic pressworkers. Some of the other important printing skilled workers are bookbinders, photoengravers, electrotypers, and stereotypers.

2. Machine Maintenance

A number of different trades are employed in the maintaining of machines that produce copy and actually do printing. For instance, maintenance machinists repair and adjust typesetting machines, printing presses, or bindery equipment. They are usually found working in large plants. In most of the smaller plants the owner may hire someone to do the work whenever it is needed.

3. Communications Careers

The communication field requires a number of highly trained and specialized people. These jobs in particular, require people with special skills or training.

The future of communications jobs will continue to be bright. More and more people will have to be trained to keep present equipment operating. New technological improvements will demand retraining of persons in some fields. This means that persons who work in this field will have to be willing to accept a lifetime of training and on the job instruction. It is not an area in which a person can be trained and expect to use the same kind of skills forever.

The communications field will continue to offer opportunities to those who want to improve their minds and skills. It will continue to move ahead with the demands of a changing society. It will present young people with challenges and ideal working conditions. It offers something to everyone interested in becoming something better than they are at the present. It offers the chance for those who are working to move up and become more skilled or better paid.

You are limited only by your ambitions and ability in this field.

Drafing technicians may be involved in a number of steps in the development of a product, house, or bridge. If it is to be built, they must communicate the ideas of the engineer and designer to the people who will be doing the building. The job of a drafing technician is very important. It may cost millions of dollars to correct the damage done by a wrong dimension.

Drafting technicians may be in on the development of a project from the start. However, if the job is a large building or product, a technician may be given only a small portion to work up. A plan must be developed and a design must be produced in most instances.

Training Requirements

Apprenticeship is a common method of getting a start in the printing crafts. In some cases, it is the only means by which a person may be trained to become a journeyman (skilled worker) in a unionized shop. A formal program of apprenticeship is required for journeyman status in many larger establishments that are not unionized.

In 1970 there were about 13,800 apprentices registered and in training in the skilled printing crafts. A registered apprentice is an employee who, under an agreement, receives instruction in a specific occupation for a specified period of time. The apprentice is registered with a state apprenticeship agency or the U.S. Dept. of Labor's Bureau of Apprenticeship and Training.

Apprenticeships for the printing trades usually last from 4 to 6 years. The program covers all sides of the particular trade. It generally includes classroom or correspondence study courses. The materials studied is directly related to the job being done at the time. As new printing methods are developed and introduced, they generally are included in the duties of the traditional printing crafts and in the apprenticeship program.

Apprentices are usually required to be between 18 and 30 years old. They must pass a physical examination. There is, however, no age limit (maximum) for entering many of the printing crafts apprenticeship programs.

Most employers require a high school diploma or an equivalent education program, for entry into the apprenticeship program. A thorough knowledge of spelling, punctuation, the fundamentals of grammar, and basic mathematics is essential in many of the printing trades. A knowledge of the basic principles of chemistry, electronics, and physics is becoming increasingly more important because of the growing use of photomechanical and electronic processes in printing. An artistic sense is also an asset, since the finished product should be pleasing in balance and design.

Most printing crafts require persons with good eyesight, about average physical strength, and a high degree of manual dexterity.

Mental alertness, speed combined with accuracy, neatness, patience and the ability to work with others are also necessary. The ability to tell the difference between colors is important in those areas of printing in which color is used. Many employers require applicants to take one or more aptitude tests. These were developed for the printing industry occupations by the U.S. Dept. of Labor.

These tests are given in the local offices of the state employment services. Apprentices often are chosen from among young people employed in various unskilled jobs in the printing establishments. They should be people who demonstrate the mechanical aptitudes needed for the printing crafts.

There are about 4,000 schools (high schools, vocational schools, technical institutes, and colleges) that offer courses in printing. These courses help you to be selected for apprenticeships or other openings in the printing and publishing industries.

Image Transfer Devices

The technology of printed graphic communiction is composed of several processes. Among these are image design, image composition, image preparation, and image transfer. Image transfer is the subject of this reading.

There are five basic processes involved in image transfer. They are letterpress, lithography, silk-screen, gravure, and electrostatic. All of these processes accomplish essentially the same thing--the transfer of an image from a carrier to a sheet or roll of stock.

Letterpress printing is the oldest of the processes. The earliest form was done from wooden blocks in China about 868 A.D. . Block printing spread to Europe and was first done there in 1377 A.D. The significant breakthrough in printing occurred in 1450 A.D. when Johann Gutenberg developed the process of printing from movable type.

Letterpress printing is the process of printing from a reversed, raised surface on an appropriate material (usually paper). The process involves the following sequence: preparation of the image carrier (type) inking of the image carrier; contacting the printing stock (paper) to the image carrier; application of pressure to the paper; and removal of the paper from the press.

There are several styles of letterpresses including: platen press, flatbed cylinder press; and rotary press. The platen press is probably the most common, however, the majority of production printing is accomplished with the cylinder press and the rotary press.

While most printed products can be printed with the letterpress, it is best suited to alphabetical material. Some of the most common products produced with the letterpress are: letterheads, envelopes, tickets, and office forms. However, some newspapers, textbooks, and advertising materials are still produced with the letterpress. It is not well suited to the reproduction of photographic types of material or to line drawings. As a result, most materials of this type are produced by other techniques.

There are still many careers available to those desiring to enter the field of letterpress printing. Some of these are compositors (linotype operators, stonemen, etc.), layout men, proofreaders, pressmen, and bindery personnel.

Lithographic printing (also called offset lithography) is a rapidly expanding process in printed graphic communication. It is based on the principle that oil and water will not mix. As a result, the image carrier (plate) is prepared in a way that the printing image will accept ink and the non-printing surface will not. When water is applied to the plate, the inked surface repels the water while the non-inked surface accepts it. The ink plate is then contacted to a rubber blanket to reverse the image. Paper or other printing stock is then contacted to the blanket under pressure producing the printed material.

The basic principle (oil and water will not mix) was discovered, more or less by accident, by Alois Senefelder in 1798 while he was experimenting with printing from stone. As a result, early lithographic printing was done from stone blocks. (Thus, the name lithography--stone printing.) The process did not become widespread until the technique of offsetting the image onto another surface was discovered in 1904. The discovery of this process led to the rapid expansion of the process and to its common name today--offset printing.

Offset lithography is especially well suited to the printing of illustrated materials both photographic and line copy. The capability of offset lithography to reproduce photographs (halftones) is its principle advantage. As a result, it is commonly used to print newspapers, magazines, advertising materials, and other materials making extensive use of photographs. It is commonly used in office reproduction because of the ease of preparing short run image carriers with a typewriter.

There are two basic types of offset lithography printing presses. They are sheet fed presses and web fed (roll) presses. The web fed press is an extremely high production process and is commonly used for newspaper printing.

There are many careers available to those persons interested in entering the field of offset lithography including: layout and design workers, compositors, cameramen, strippers, platemakers, pressmen, and bindery workers. The skills required for certain careers in offset lithography are very sophisticated, and as a result, persons with these skills are very well paid.

Two additional image transfer processes are gravure printing and silk-screen printing. Gravure printing is used to produce treasury notes, stamps, some magazines, some newspapers, and some advertising material. Silk-screen is used for greeting cards, signs, lampshades, carpeting, bottles, wallpaper, and textiles. The outstanding characteristic of silk-screen printing is its adaptability to printing on irregular surfaces such as bottles and cans.

Gravure printing (also called intaglio) prints from an image carrier with the printing areas depressed (the opposite of letterpress). The depressed areas act as ink wells and when printing stock is contacted to them under pressure a printed product results. It is used for treasury notes and stamps because of the difficulty of producing counterfeit material using the same process. Gravure presses are of two types, sheet fed and web fed.

The image carrier for silk-screen printing allows ink to pass through a porous material in the printing area. Printing stock is placed under the image carrier and ink is forced through the carrier onto the paper. Image carriers for silk-screen may be prepared by hand (stencils) or photographically. It is not a high production process and is best suited for special printing applications such as printing on irregular surfaces.

The most recently developed image transfer process is electrostatic printing. The process involves an electrically charged image carrier which positions the printing image on the carrier through magnetic forces. The printing stock is then contacted to the image carrier and fine pigmented particles are metered through the image carrier onto it. The process has been made famous by the Xerox Corporation and as a result it is commonly called xeroxing.

Student Activity #1

Description: Given a message to communicate to a specific audience, the student will choose what he feels to be the best medium to convey this message. He will then make rough sketches and outline the procedures which he feels should be followed in developing and disseminating the product. After this, the class will discuss the advantages and disadvantages of the decisions made by each student.

Teaching Procedures: Divide the students into groups of four or five and assign each group a message to communicate and the type of audience to whom it will be communicated. Then, instruct each student within the group to choose the medium which he feels is best suited to communicate the desired message and to also make rough sketches and outline the procedures that should be followed in developing the product, disseminating it, etc. After each student in each group has completed this, the class should discuss the advantages and disadvantages of the decisions made by each student.

Equipment and Supplies: Drawing pencils
Drawing paper

POSTERS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of posters and the interrelationship of design and layout with all aspects of graphic communications.

CONTENT OUTLINE:

1. Developing a poster
    a. Thumbnail sketches
    b. Rough layout
    c. Comprehensive layout
    d. Type composition
    e. Paste-ups
    f. Printing
2. Elements of Design
    a. Line
    b. Texture
    c. Value
    d. Space
    e. Color
    f. Hue
3. Principles of Design
    a. Utility
    b. Rhythm and repetition
    c. Proportion
    d. Balance

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.

3. Attend classroom discussions covering posters and design considerations.

4. Do classroom demonstrations as required.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on posters and design considerations.

2. Discuss the principles of sketching and design consideration as applicable to the graphic communications industry.

3. Complete assigned lab activities.

OUTLINE OF CONTENT

I. Steps Involved in Producing a Poster

A. Thumbnail Sketch - Thumbnail sketches are used mainly to suggest the position of the different parts of the poster. By working broading and at a small scale, many arrangements can be made quickly (teacher will demonstrate).

B. Rough Layout - Rough layout should be actual size and should give specifications for size and kinds of type required and their location. This is a guide for composing type (teacher will demonstrate).

C. Comprehensive Layout - Comprehensive layout is almost an exact copy of how the printed piece will appear after its completion. A comprehensive layout is frequently required for many jobs reproduced in industry (teacher will demonstrate).

D. Type Composition - Most modern type composition is done in one of the following two ways:

1. Photo Composing Machine - Operated with a keyboard similar to a typewriter. Many kinds of photo composing machines are available. Some are very simple and inexpensive, while others are more complex and very expensive. Almost any style and size of type is available on modern photo composing machines (TM #1).

2. Pre-Printer Alphabets - Available in a wide variety of sizes and styles of type. Transfer letters consisting of black images and transparent sheets are commonly used. when transferred to transparent acetate a transparent positive can be used in making photo screen stencils without making a positive photographically (TM #2).

E. Paste-Ups - A layout table or drawing board with "T" square and 1 triangle are helpful for making good paste ups. Guidelines are used to assist in properly locating the various parts of the image to be assembled and to keep each part square. Copy preparation layout and pasteup for screen printing are the same as for offset reproduction.

F. Printing the Poster - Most posters are reproduced by either screen printing or offset. The factors determining selection of the printing process includes design, size, thickness of stock, and length of run. If the design includes a photograph or a long run (100 or more) offset is recommended. It is not practical to print 4-ply poster board on small offset presses.

II. Elements of Design Information Sheet #2)

A. Line

B. Texture

C. Value

D. Space

E. Color

F. Hue

III. Principles of Design (Information Sheet #3)

A. Unity

B. Rhythm and Repetition

C. Proportion

D. Balance

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THUMBNAIL SKETCHES

Thumbnail sketches are simple idea sketches which help both the designer and economic growth and explosive expansion of the planned product in many ways to obtain an attractive, acceptable final result. The purchaser can see the ideas and choose the layout which he prefers.

Thumbnail sketches serve three primary purposes: They (1) graphically preserve ideas, (2) visually portray ideas, and (3) compare two or more ideas visually.

Preparation of these sketches should begin immediately after the desired product has been selected and after completion of the prelayout planning sheet (Fig. 18-1). Copy selection precedes thumbnails; therefore, one of the responsibilities of the designer is to obtain the copy that will appear on the final product. The originator of the planned printed product should have this information available.

Method of Preparation

1. Prepareand prelayout planning sheet and list the copy.

2. Choose the final size of the printed product and plan to sketch the thumbnails 1/4 size.

3. Select copy elements needing emphasis. Block and shade areas of space in the approximate position that each element is desired. The space given should be a representation of the desired final size.

4. Use straight lines to represent type that is 12 points or smaller in size. Do not use lettering for either the large or small type.

5. Outline the space for illustrations or photographs. Within this space, sketch the illustrations or content of the photograph. This permits another person studying the sketches to obtain a basic idea of the content. Detail is not needed for thumbnail-sketch illustration or photographs.

It is important to sketch several ideas from which a final selection can be made. Prepare as many thumbnail sketches as you have ideas. Skilled designers prepare at least four of any copy given to them. It is sometimes difficult forthe beginner to visualize a large number of possibilities.

Figs. 22-1 and 22-2 are examples of thumbnail sketches. The copy for Fig. 22-1 is as follows:

Baseball
Support Little League
Every Saturday 9:00 a.m. Valley Park
Sponsored by: City Council

Study the copy. Note various positions or locations in which copy elements could be placed for each of the four thumbnail sketches.

Copy listed for Fig. 22-2 includes:

Summer Clothes Drive
April 8
We Need Clothes
Please Contribute
Bring Clothes to Main Lounges of the Dorms,
7:00 to 9:00 p.m.

Note that only the word content is listed. In most situations it is the responsibility of the designer to select an illustration.

THE ROUGH LAYOUT

The second major step in layout procedure is the preparation of a rough layout. The rough is an improvement or refinement of a thumbnail sketch, or even a combination of two or more.

Purposes of a rough layout are to (1) force a selection of one of the several sketched ideas, (2) begin refining a specific idea, and (3) provide a tangible item that can be studied and changed. Actually, a rough layout can be considered a prefinal product.

Method of Preparation

1. Study the several thumbnail sketches that have been prepared.

2. Select the one that best presents the content of the final two-dimensional product. Selection is made by the designer and/or the purchaser.

3. Obtain a sheet of paper that will allow the layout to be drawn full size.

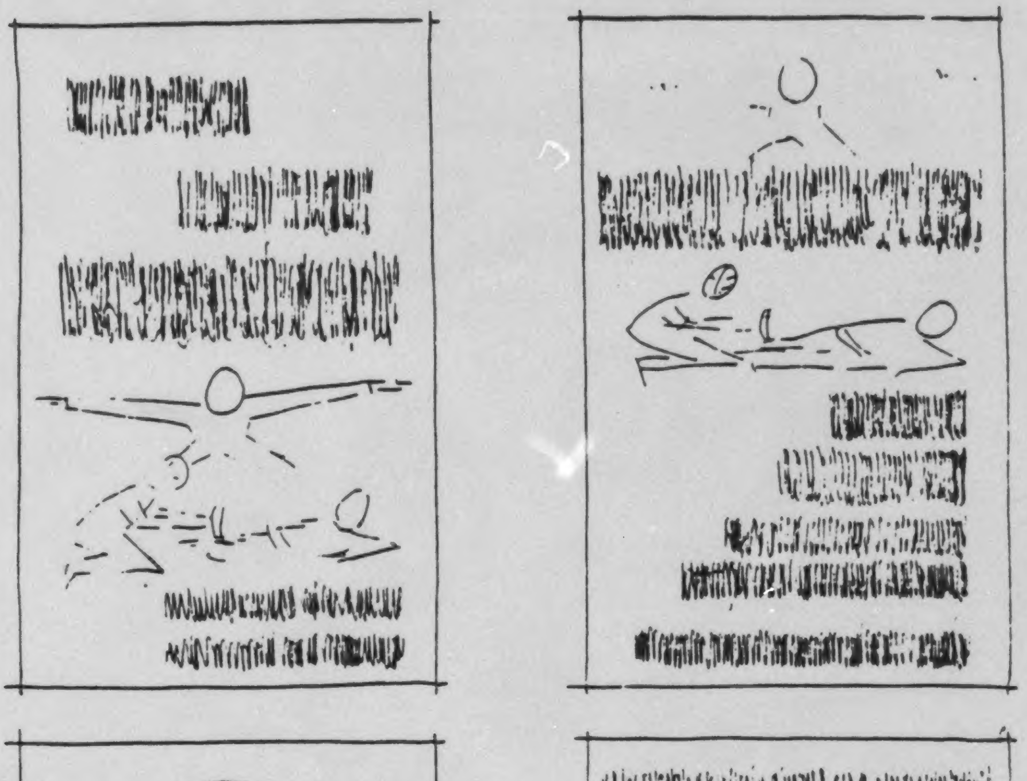
4. Block or outline the area that will be devoted to type and illustrations according to the thumbnail or combinations of them selected (Fig. 23-1).

5. Add type to the rectangular outlined areas, based upon the copy. Straight lines signify 12-point type and smaller.

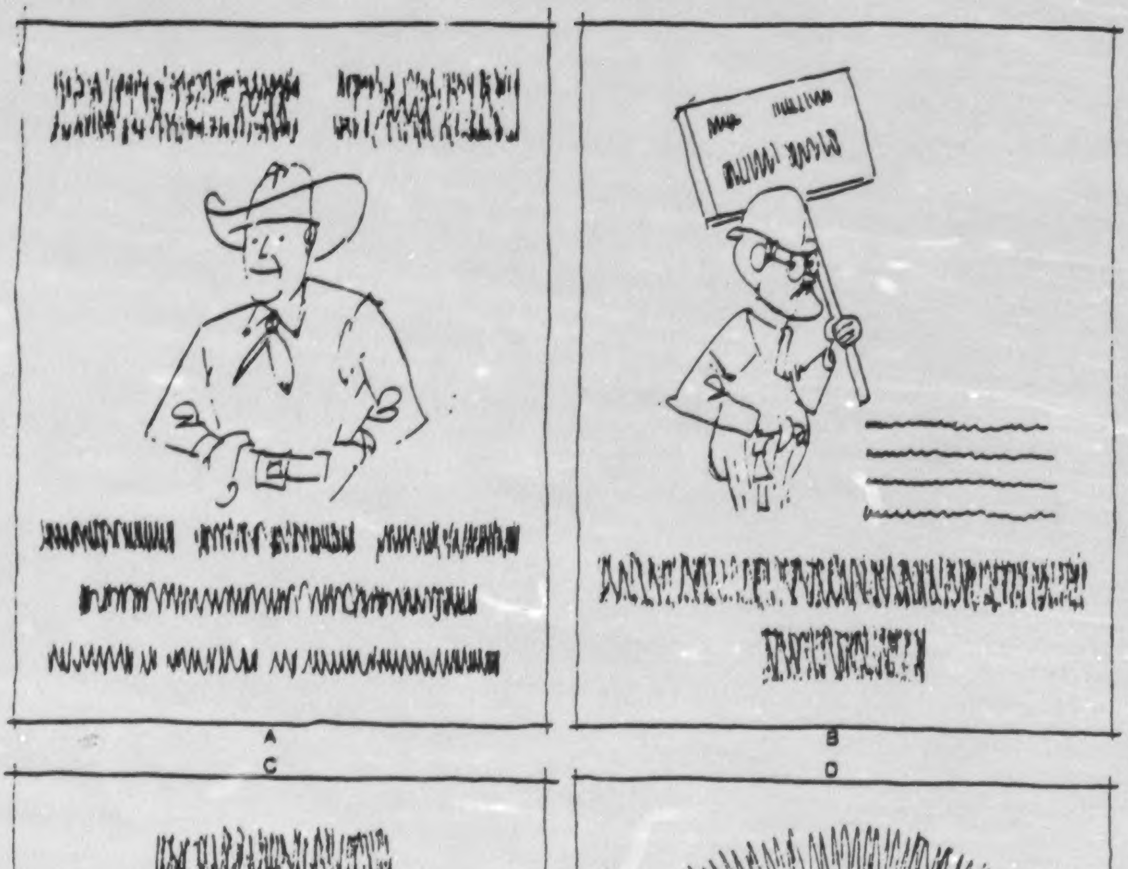
6. Sketch the illustrations within the outlined areas (Fig. 23-2). They should be of a higher quality and contain more detail than a thumbnail-sketch illustration. The rough layout should reasonably resemble the finished product.

7. Study the rough layout; make additions or changes. Consult the purchaser of the final product as this gives him the opportunity to suggest necessary changes.

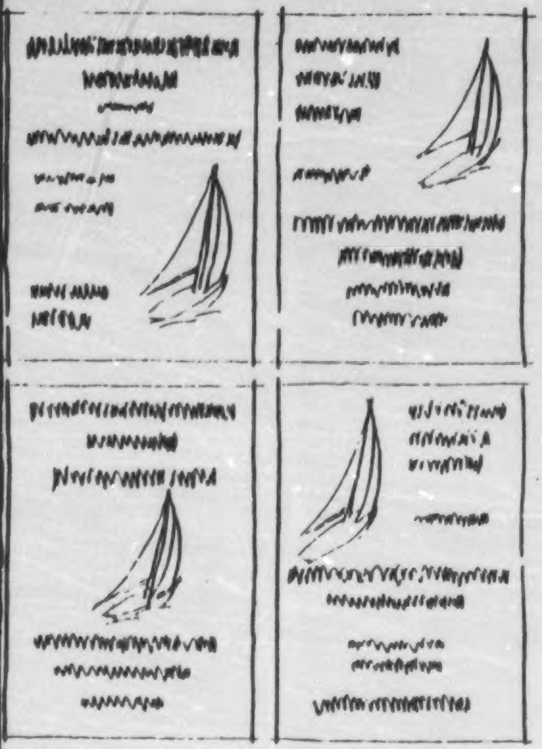
As noted in the previous procedural steps, it is possible to combine two or more thumbnail sketches to obtain the basic appearance for a



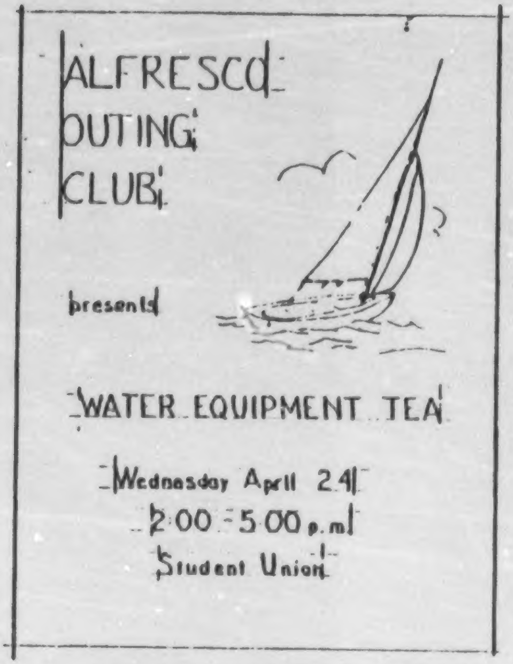
A set of thumbnail sketches based upon predetermined copy



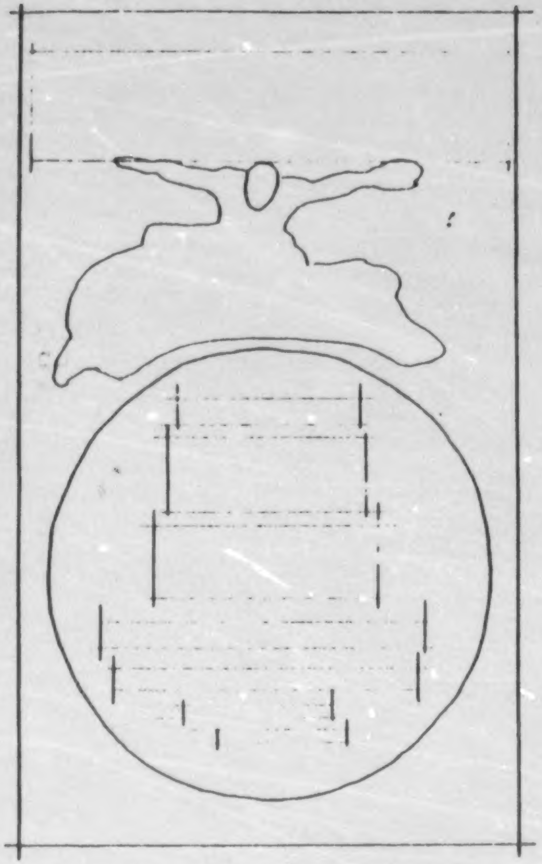
A set of thumbnail sketches. Note that each sketch contains a different illustration, but has provision for the same copy.



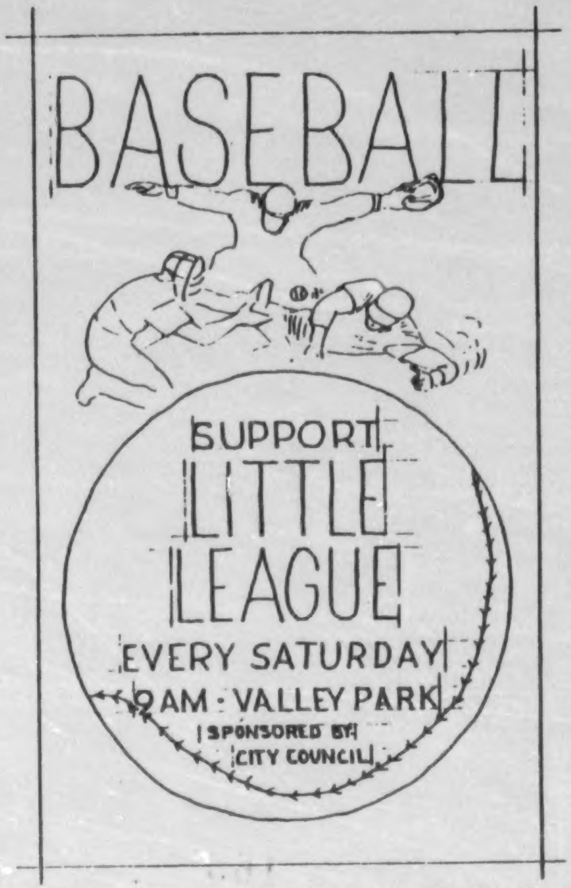
Thumbnail sketches, the first important step in two-dimensional graphic layout


ALFRESCO
OUTING
CLUB
presents
WATER EQUIPMENT TEA
Wednesday April 24
2:00 - 5:00 p.m.
Student Union

Rough layout, the second step in two-dimensional graphic layout.



Beginning a rough layout based upon thumbnail sketch *D*


BASEBALL
SUPPORT
LITTLE
LEAGUE
EVERY SATURDAY
9 AM · VALLEY PARK
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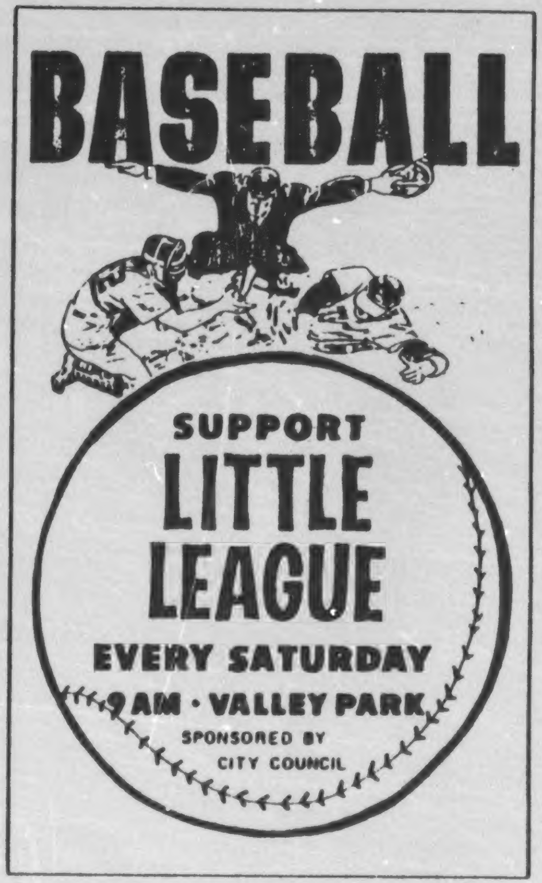
Words and illustrations placed within the outlined areas.


BASEBALL
SUPPORT
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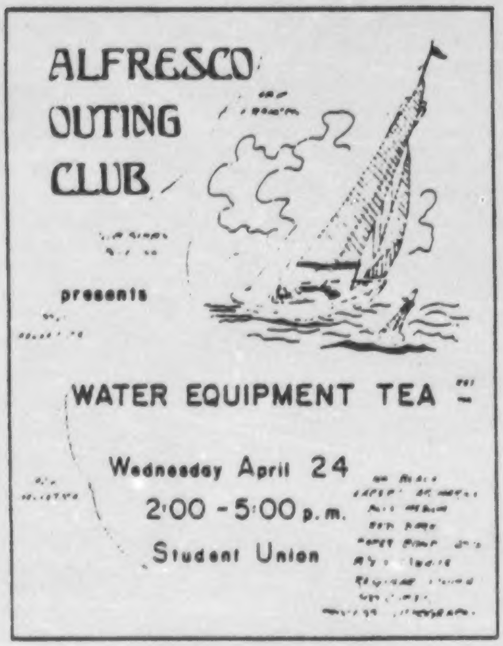
The first three steps of a comprehensive layout have been completed, based upon the rough layout



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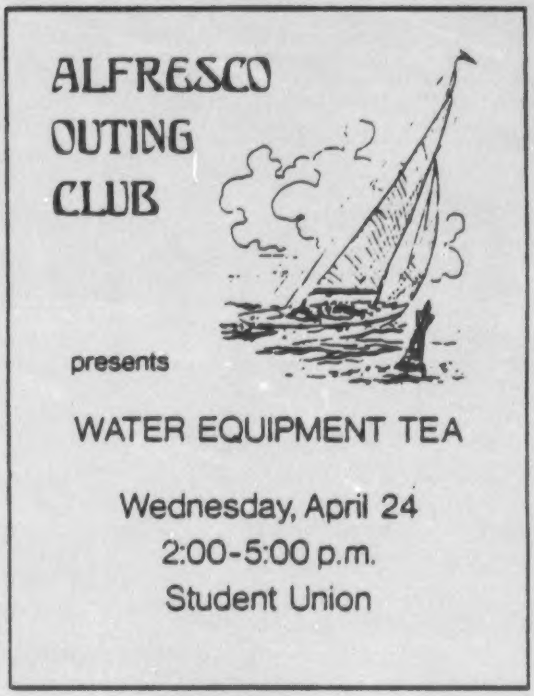
Comprehensive layout, the third step in two-dimensional graphic layout (point sizes are larger than shown).



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A finished or final layout. It is also called a *mechanical*, and can be used for camera-ready copy.

rough layout. An example of such a combination is shown in Fig. 23-3. This rough is based upon two thumbnail sketches (A and D) in Fig. 22-2. Study these two figures to see how the combined rough layout was made.

THE COMPREHENSIVE LAYOUT

The comprehensive layout is the most important step in the production of a printed work. It is the master plan or blueprint of the finished product, and therefore its value cannot be overemphasized. It allows the designer and the purchaser to see the finished product and to change it if necessary.

After the designer and purchaser have made all necessary decisions, the comprehensive layout will contain all information needed to complete the printed product. It will guide specialists who will produce the final product.

Steps of Preparation

1. Study the rough layout.

2. If the complete material is to be multiple colored, choose the colors and the content for each. Use colored pencils to represent the color of each element.

3. Letter all type in the exact position desired. Make the type look like the actual kind. Study Fig. 24-1 for the first three procedural steps.

4. Lines should be used to designate the correct position, even if the layout contains 12-point type or smaller. However, the typewritten copy should also be attached.

5. Draw the illustrations carefully in the correct positions.

6. Block the space for the photographs, if they are used, and attach the glossy print if it is available. If the photographs have not yet been taken, give directions as to the content and where the subject or photograph contents can be obtained.

7. Prepare an overlay sheet after all content has been placed on the layout.

8. Thoroughly review the layout. Be certain that you have included all copy and given full production information on the overlay sheet. For detailed instructions on how an overlay sheet should be prepared, study the following seven steps.

Information Sheet #2

Elements of Design

1. Line - An important element of design and one that creates many different feelings is line. Lines may be short and heavy, or long and lean, straight and curved, dotted or dashed, or one of many others you may or may not have seen.

2. Texture - To give the viewer the idea of an object with a rough surface or to show the realistic surface of the object being drawn.

3. Value - Value deals with the lightness and/or darkness of a color. If you were to take what we call a pure color and add white it would be called a tint. If black were added, it would be called a shade. By adding either black or white, you will change the value of the original but it will not change the hue. This value change may also be accomplished using only the values of black and white to form grays.

4. Space - The area in a picture (two dimensional surface) or drawing that separates the items or objects. As objects advance (come forward) or recede (go back) in the picture, space is created. The use of value in color creates space.

5. Hue - Hue is the name of a color. It is the way we can recognize one color from anoter. An example would be a green leaf. Green is the hue, leaf is the object. Red wall, red is the hue, wall is the object.

6. Primary Colors - The primary colors for pigment (or paint) are: red, yellow and blue. Mixed, these three colors will make about every hue (color).

7. Secondary Colors - The Secondary Colors are made when any two primary colors are mixed in equal quantities. The Secondary Colors are: red + blue = purple, blue + yellow = green, yellow + red = orange.

8. Tertiary Colors - The mixing of a primary color with a secondary color, whatever the proportion, you get a tertiary color.

9. Complementary - Any two colors that are opposite each other or the color wheel. Complements, when mixed, tend to dull each other.

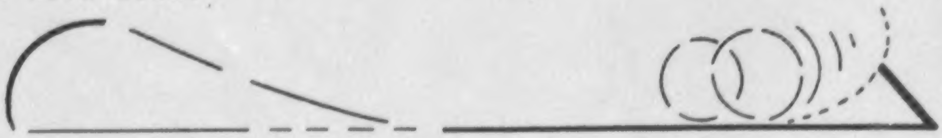
10. Monochromatic Color - The use of one color in varying tones and intensities.

STUDENT HAND OUT
ELEMENTS AND PRINCIPLES OF DESIGN

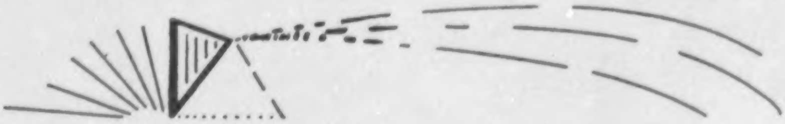
The following vocabulary terms should help you in achieving a large amount of success in design. Follow each area separately using your own ideas. After you have completed them, combine several into one picture.

Elements of Design:

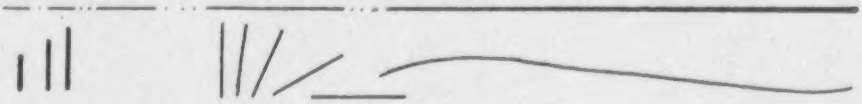
Line: An important element of design and one that may create many different feelings is line. Lines may be short and heavy, or long and lean, straight and curved, dotted or dashed, or one of many others you may or may not have seen.



Lines may give you the feeling of going slow or fast, of being static (vertical), or dynamic (horizontal). Lines create energy and direction

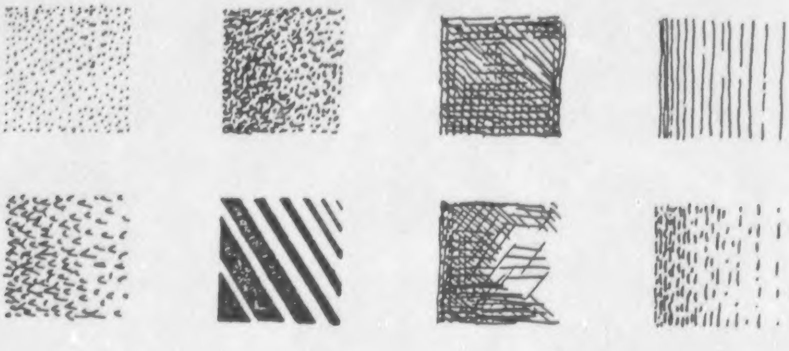


Can you find the different types of lines in this drawing?

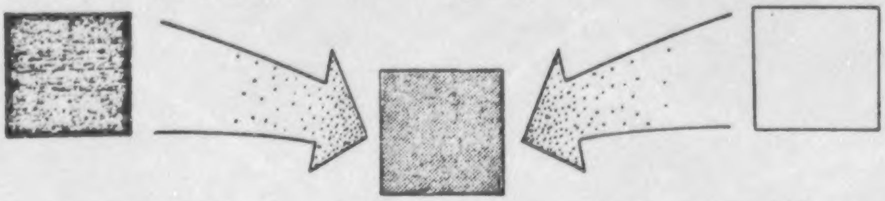


Texture: To give the viewer the idea of an object with a rough surface or the realistic surface of the object being drawn.

Examples:

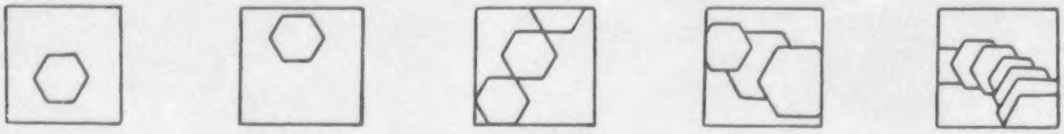


Value: Value deals with the lightness and/or darkness of a color. If you were to take what we call a pure color and add white, it would be called a tint. If black were added, it would be called a shade. By adding either black or white, you will change the value of the original color. This value change may also be accomplished using only the values of black and white to form greys.



By mixing more or less black, you may obtain different values of grey. These value changes will help you to create depth in your pictures. As you go back (recede) into your picture, the value should become darker. As you come forward (advance), the value should become lighter. These changes create depth through the use of value.

Space: The area in a picture (two dimensional surface) or drawing that separates the items or objects. As objects advance (come forward) or recede (go back) in the picture, space is created. The use of value in color may also create space. Look at the following boxes for examples of spacing.



Color: There are many different things about color you should know before you understand its use.

Hue. Hue is the name of a color. It is the way we can recognize one color from another. An example would be a green leaf. Green is the hue, leaf is the object. Red wall. Red is the hue, wall is the object.

Value. Value allows us to see the lightness or darkness in a color. It also allows us to see a natural (neutral, normal) color. If we were to start with a natural blue and add white, it would make a light blue or a tint. If black were added to the natural blue, it would be called a shade. Adding black or white will change the value of a color, but it will not change the hue.

Draw five (5) squares. Pick a primary color (such as blue). Paint in the center square. Now mix five (5) small drops of white into the blue paint. Paint them into the first square to the left. Add five (5) more drops of white paint and paint the next square to the left.

Take some more, unmixed blue paint. Add five (5) drops of black paint and paint the first square to the right. Add five (5) more drops of black paint to the blue, and paint the last square. You should now be able to see a small value scale of blue colors.

Intensity: Intensity deals with the saturation of a color, or how strong or weak it is. The intensity of a color may be changed by adding a grey color of equal value. This change will not effect the value or hue of the color. (Do not confuse value with intensity.)

Primary Colors: In this handout, we will use the primary colors for pigment (or paint) which are: red, yellow, and blue. With these three colors just about every color (hue) may be mixed.

Secondary Colors: If you mix any two primary colors in equal proportion, you will have created an intermediate color or secondary hue. In some cases the primary colors are not of the same intensity. Therefore, mixing colors equally may not give you the results you want.

Tertiary Colors: By mixing a primary color with a secondary color, in what ever proportions are necessary, you will end up with a tertiary hue. These colors are labeled with the primary color first: red orange, red violet, blue green, and others.

Complementary Colors: Complementary colors are any two colors that are opposite each other on the color wheel. When we mix complements, they will tend to dull (grey) each other. When they are put next to each other, they may adhance or destroy your work depending on how they are used.

Monochromatic Color: If you were to choose one color for a complete picture, and using nothing but value and intensity changes, you will have a monochromatic color scheme.

Analogous: Colors which are close to each other on the color wheel are called analogous. An example would be orange, yellow and green. Or yellow orange, yellow and yellow green. All three colors will be in a row or contain a common color.

Principles of Design:

Informal Balance: Informal balance is a much more dynamic form of balance. This form has movement, interaction, and direction caused by the various shapes and lines. There are no hard rules for this type of balance so you must depend on your own sense of balance to achieve a well designed drawing or picture. Remember, however, the more lines and shapes you use the harder it will become to balance the design.

Unity: A drawing that does not contain unity will not hold the interest of the viewer. Unity may be used with objects that are similar or by the arrangement of different objects. Whether you use similar or different objects to complete your work, it is important that the whole arrangement be pulled together into one visually.

Rhythm and Repetition: As in music, rhythm and repetition play an important part of the final product. You may obtain either or both of these principles by alternating or repeating shapes. The use of lines and angles, direction and intervals is another way of reaching the same goal. If you vary the shape and/or size of the objects in your drawing, and in an orderly fashion, they will act in a rhythmic movement, also. See if you canname some objects that show rhythm or repetition.

Proportion: To maintain interest and variety in your picture, proportion becomes very important. To do this you should divide the area of your picture into varying sizes. Dividing your picture in halves leaves everything static, uninteresting, and takes away from the unity of your picture. Dividing the picture into thirds creates a better division as units are repeated.

If we divide our paper between the 1/2 mark and the 1/3 mark we will be using the "Golden Division Rule." This rule is very imortant to the composition of any art work you may attempt.

In using the Golden Rule in your drawings locate it on both the horizontal and vertical areas of your picture. Where these two lines cross is a very strong point of interest. Working your drawing along these lines and directing the viewer toward the pont where they do cross will greatly enhance your design and the finished product.

Balance: An important principle of composition is balance. There are two forms of balance which you will most likely use in the graphic communications field: formal (or symmetric) and informal (or asymmetric). Formal balance is done by using a real or imaginary line on your paper. Everything tha is placed on one side of this line is duplicated on the other side, in the same order and position.

Contrast: Contrast is the one area of your picture that adds life. This effect can be accomplished in several ways. The use of large against small, or light against dark are two of the many ways you may use contrast.

The use of color may also form contrast in your picture. Place a circle of one color (red) inside a square (green). After this is finished, reverse what you have done: put a green circle in a red square. Now notice what has happened to the value of the colors and what appears to have happened to their shapes.

Information Sheet #3

PRINCIPLES OF DESIGN

UNITY: Whether you use similar or differnt objects to complete your work, it is importnat that the whole arrangement be pulled together into one idea visually.

RHYTHM and REPETITION: If you vary the shape and/or size of the objects in your drawings, in orderly fashion, they will act in a rhythmic movement also.

PROPORTION: To maintain interest and variety in your picture, proportion becomes very important. To do this you should divide the area of your picture into varying sizes.

BALANCE: An important principle of composition is balance. There are two forms of balance which you will most likely use in the graphic communications field: formal (or symmetric) and informal (or asymmetric).

SUGGESTED TEST

Poster Making

1. List steps involved in making a poster.

   a.

   b.

   c.

   d.

   e.

2. Define:

   Thumbnail sketch ____________________________________

   Rough layout ______________________________________

   Comprehensive layout _______________________________

   Paste up ____

3. What are the factors that determine selection of appropriate printing process?

ANSWERS TO SUGGESTED TEST

1. A. Thumbnail sketch
   B. Rough layout
   C. Comprehensive layout
   D. Composing type
   E. Paste ups

2. Thumbnail sketch - Used mainly to suggest the position of the different parts of the poster. By working broadly and at a small scale, many arrangments can be made quickly.

Rough layout - Should be actual size and should give specifications for size and kinds of type required for their location. This is a guide for composing type.

Comprehensive layout - Almost an exact copy of how the printed piece will appear after its completion.

Paste up - A camera piece of artwork.

3. Design, size, thickness of stock and length of run.

Student Activity #1

Follow your previous activity on the flyer in Unit IV Lesson I.

Do: Thumbnail Sketch
Rough Layout
Comprehensive Layout
Mechanical Layout

PRODUCING A POSTER

Objective:

Student will take the materials and demonstrate the ability to complete a thumbnail sketch, complete a rough drawing, and complete a comprehensive layout.

Materials:

Pencil
Compass
Ruler
T-square
Paper
Triangle
Masking tape
Marker
Pen and ink
Brush
Paint

Procedures:

Complete Student Activity based on teacher demonstration and teacher supervision, utilizing guidelines explained on Information Sheet #1.

RELIEF OR LETTER PRESS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of hot stamping and rubber stamping processes and how they relate to the graphic communications industry.

CONTENT OUTLINE:

1. Hot stamping
    a. Equipment
    b. Type
    c. Variables involved
    d. Advantages and disadvantages
    e. Student activities
2. Rubber stamping
    a. Materials
    b. Stamp construction
    c. Common uses
    d. Student activities

TEACHER ACTIVITIES:

1. Make transparencies.

2. Present information relative to the content outline.

3. Attend classroom discussions covering hot stamping and rubber stamping processes.

4. Do classroom demonstrations as required.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on hot stamping and rubber stamping.

2. Discuss the basic principles and differences between hot and rubber stamping.

3. Complete assigned lab activities.

HOT STAMPING

OUTLINE OF CONTENT

I. What is Hot Stamp Printing?

A relief printing process; also known as gold stamping.

A. Three basic elements

Type, foil and item to be printed

B. General printing procedures

Type is placed chase or head of printing press; heat is applied to the metal type and it is pressed down onto the item with a specially prepared foil between the type and the item being printed. The heat and pressure to the raised portion of the type causes the foil to release from the carrier and adhere to the item being printed. The pressure and the amount of time pressure is applied "dwell time" will cause the imprint to be slightly indented into the item.

C. An extension of Letterpress

II. Basic Equipment

A. Press (Transparency #1 - Parts of the printing press)

1. Hand-operated press

The press should have at least two or more different heat settings; pressure and dwell time are controlled by the operator.

2. Air-operated press

The press should have at least two or more different heat settings. Pressure and dwell time are set controlled and will operate at the same pressure and dwell time until controls are reset. An automatic foil feed is necessary for speed; the foil advances automatically each time you make an impression.

3. Jig (Transparency #1 - Jig)

The jig keeps the item from moving while being printed. Each piece is registered in exactly the same way and supported underneath, if necessary, to take the pressure off the press. Commercial jigs are available for some items, e.g., pens, pencils, satin award ribbons, matchbooks, etc.

C. Types (Transparencies #2, 3, 4 - Type)

1. Hand type

Also known as printers type; each letter cast into its own individual piece of lead to be placed onto the composing stick, by hand, for printing.

2. Linotype machine/Ludlow machine (slugs)

These two types of machinery, a linotype machine and a Ludlow machine, will set a line of type on a single piece of lead. The lines are called "slugs," and are used in the manufacture of rubber stamps and in letterpress printing. The linotype machine is operated like a typewriter; when the operator punches the keys, molds are composed to form a letter. The Ludlow machine requires hand set molds. Both hand type and slugs are limited to lettering.

3. Photo-engraved zinc/magnesium dies

Art work - photo type
Photo-engraved zinc/magnesium dies permit any black and white artwork to be hot stamp printed by etching the artwork onto a plate or die and mounting finished product "type high." Additionally, the photo engraved zinc or magnesium die will outlast either form of type (hand or slugs) and can be obtained from a photo engraver.

4. Word Spacing (Transparency #5)

Spacing between the words is accomplished by inserting pieces of metal which are lower than the type iteself. Being lower they do not come in contact with the paper and do not print. These pieces are called "quads" and are related in size to the "em quad," which is the square of the type size. For instance, if the type is 60 points, the em quad is a square 60 points by 60 points.

5. Leading (Transparency #5)

In addition to the space between the words, it is also possible to vary the space between the lines. To accomplish this, metal strips of various thickness are placed between the lines of type. This is called leading and the leads are measured in points. Their function is merely to separate the lines of type. They are less than "type-high" and do not print.

D. Foil

A type of foil with specially prepared backings designed to adhere to the many different materials hot stamp printed. Comes in colors, gloss, flat or metallic finishes.

E. Item to be printed

Most materials can be hot stamp printed, e.g., paper, cardboard, leather, suede, vinyl, plastics, etc.

III. Variables that Control Quality of Printing

A. Heat/temperature

Varies with materials being printed, and foil used; usually between 225 and 250 degrees.

B. Pressure/dwell time

Def: Pressure - weight applied to the raised portion of the type and pressed down on the item to be printed; imprint will be slightly indented.
Using manual equipment - pressure controlled by operator.
Using air operated machine - pressure controlled by operator setting automatic controls.
Def: Dwell time - amount of time pressure is applied to obtain clear impression.
Using manual equipment - dwell time is controlled by operator.
Using air operated equipment - dwell time controlled by the setting of automatic controls.

IV. Advantages and Disadvantages

A. Advantages

1. Requires no dryer

2. Economical to print--can print many different names on many different times

3. Good for short runs

4. Multi-color printing practical

5. While hand set type is demanding it is good for turning out work in a hurry

B. Disadvantages

1. Slugs break down very fast, virtually useless on hard items and for long runs

2. With slugs on softer items a run of no more than a few hundred items can be printed while maintaining quality

V. Items commonly printed by hot stamping process

A. Logos on wallets

B. Initials on luggage

C. Pencils and pens

D. Satin award ribbons

E. Napkins

F. Matchbooks

G. Etc.

VI. Hot stamp printing procedures (Student Activity #1)

VII. Career Opportunities

A. Compositor - hand, machine

1. Sets type by hand or machine and assembles products of composing machines into pages.

2. Distributes type back into cases.

3. Makes corrections as indicated by proofreader.

B. Proofreader

1. Checks galley and page proof to see if they match copy furnished by customer.

2. Checks spelling of all words and word divisions.

3. Corrects obvious errors in grammar.

C. Engraver

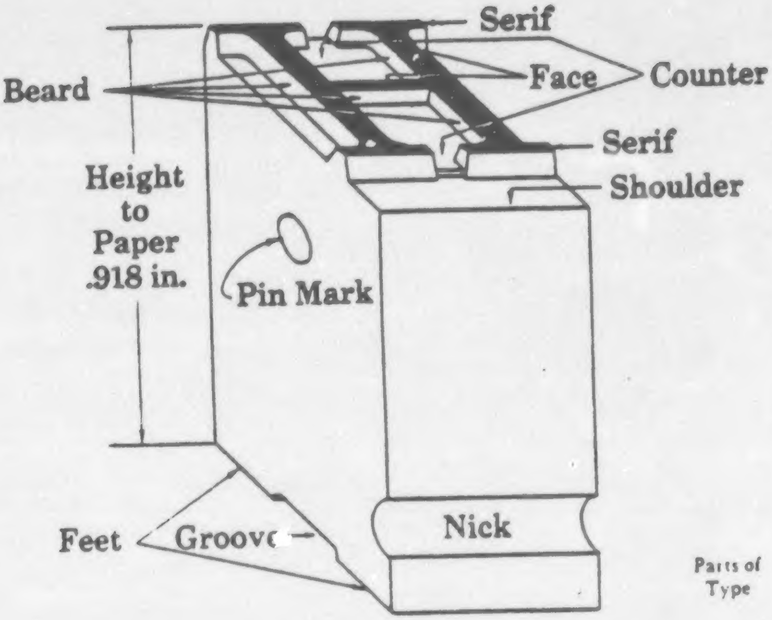
1. Take line drawing or pictures and prepares an original letterpress printing plate.

2. Mounts plate and prepares it for press.

D. Equipment maintenance

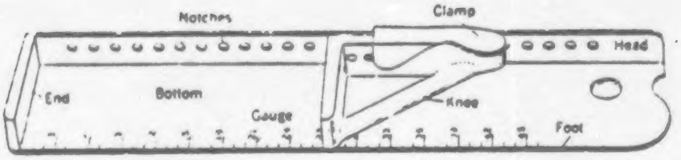
1. Has charge of maintaining and repairing all shop machinery.

2. Orders parts needed for repairs.


Serif
Beard
Face
Counter
Serif
Shoulder
Height to Paper .918 in.
Pin Mark
Nick
Feet
Groove

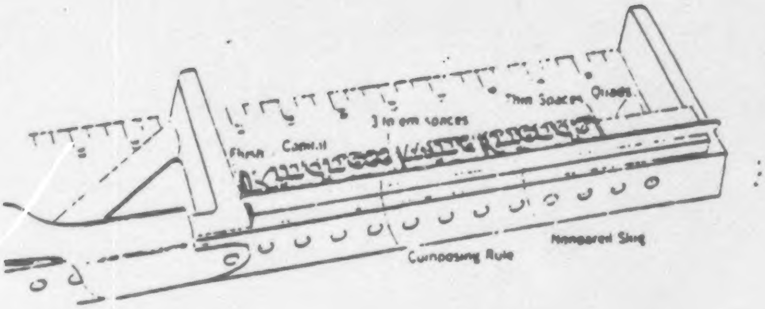
Parts of Type

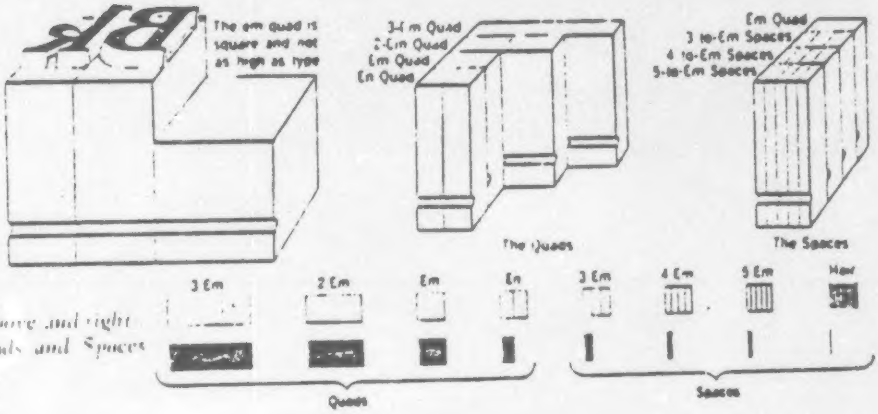
185


Notches
Clamp
Head
End
Bottom
Gauge
Knee
Foot

The Rouse Composing Stick

Justifying a Line at One End


Thin Spaces
Quads
3 to em spaces
Comma
Nonpareil Slug
Composing Rule

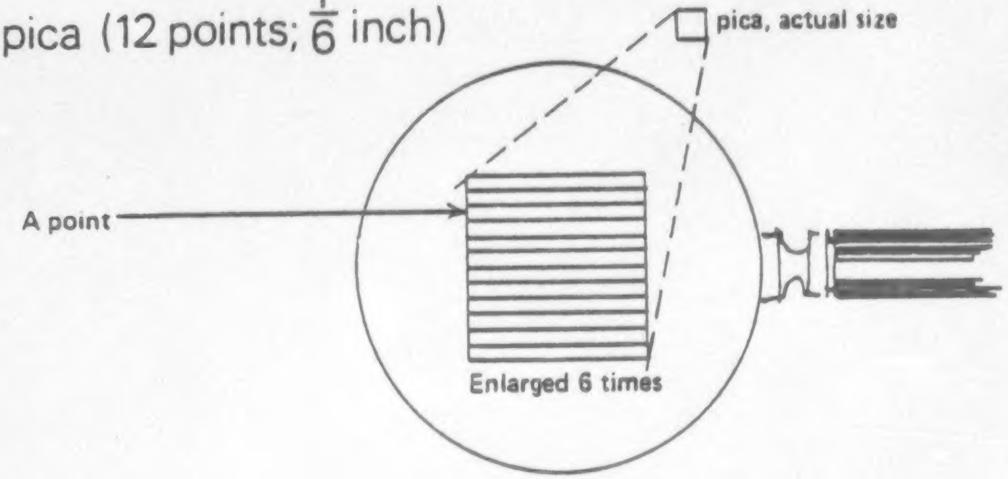

The em quad is square and not as high as type
3-Em Quad
2-Em Quad
Em Quad
En Quad
The Quads
Em Quad
3 to-Em Spaces
4 to-Em Spaces
5-to-Em Spaces
The Spaces
3 Em
2 Em
Em
En
3 Em
4 Em
5 Em
Hair
Quads
Spaces

(above and right) Quads and Spaces

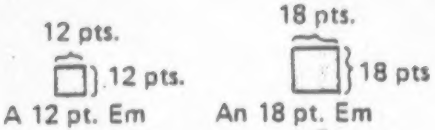
Units of Measurement

The point (approx. $\frac{1}{72}$ inch)

The pica (12 points; $\frac{1}{6}$ inch)


pica, actual size
A point
Enlarged 6 times

The Em

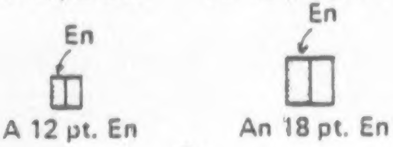

12 pts.
12 pts.
18 pts.
18 pts

A 12 pt. Em

An 18 pt. Em

(The Size of the Font Squared)

The En

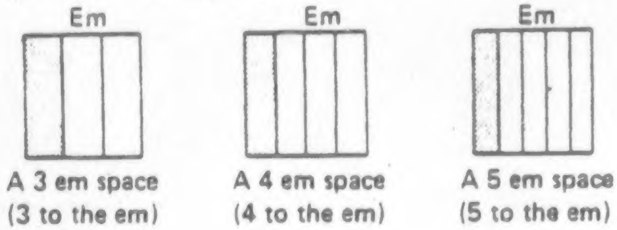


A 12 pt. En

An 18 pt. En

(1/2 an Em [Horizontally])

Em Spaces

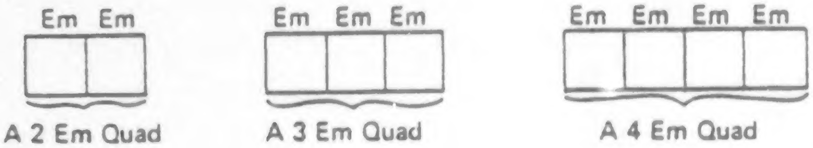


A 3 em space (3 to the em)

A 4 em space (4 to the em)

A 5 em space (5 to the em)

Quads


Em Em
Em Em Em
Em Em Em Em

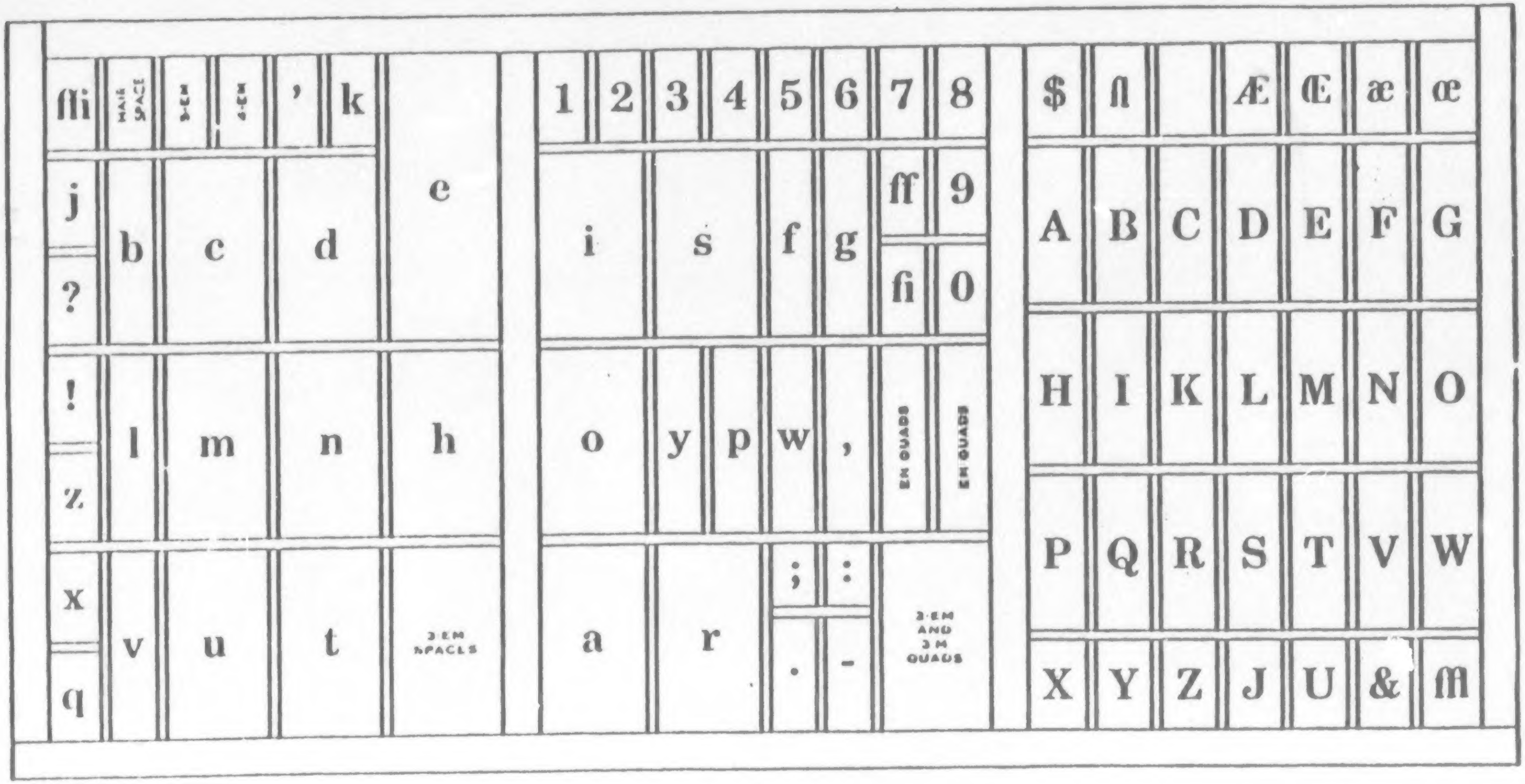
A 2 Em Quad

A 3 Em Quad

A 4 Em Quad

ETC.

LAYOUT OF CALIFORNIA JOB CASE


ffi
HAIR SPACE
5-EM
4-EM
'
k
e
1
2
3
4
5
6
7
8
$
fl
Æ
Œ
æ
œ
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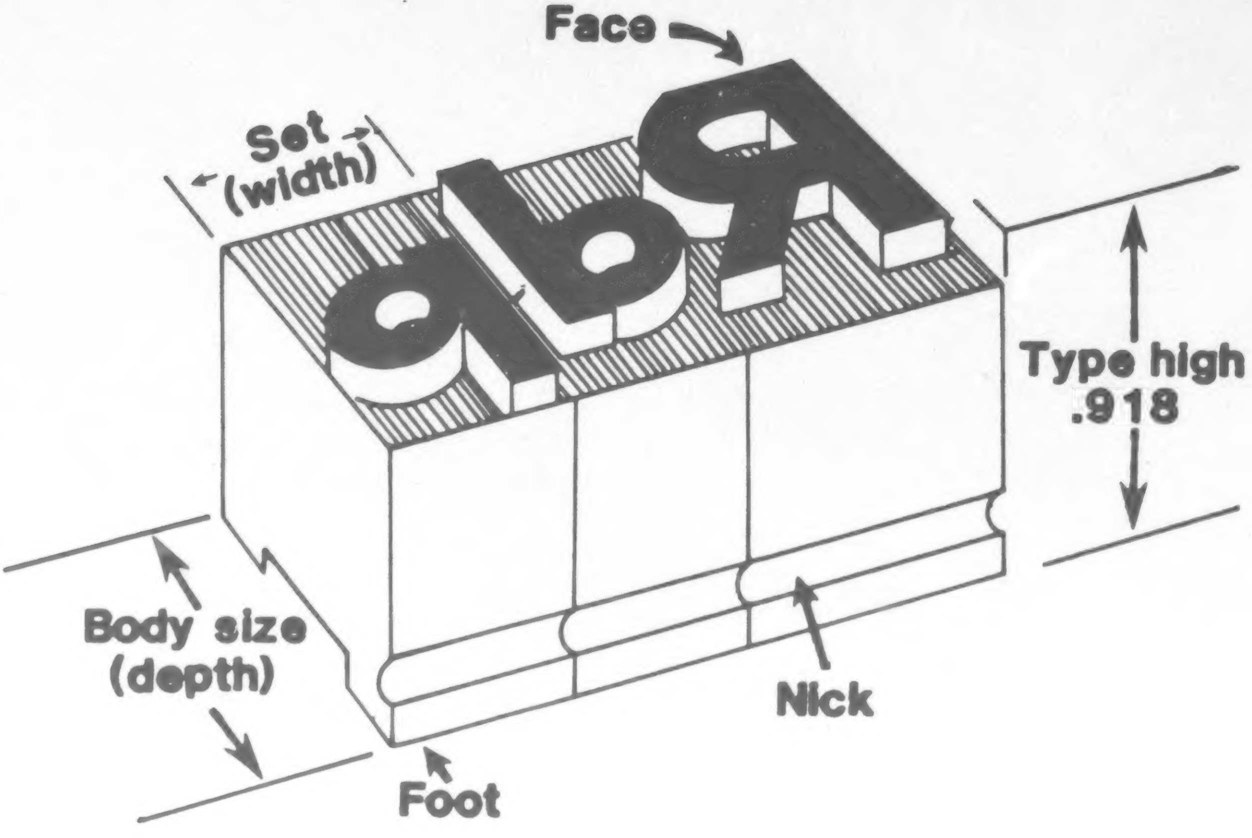
b
c
d
i
s
f
g
ff
9
fi
0
A
B
C
D
E
F
G
!
z
l
m
n
h
o
y
p
w
,
EN QUADS
EM QUADS
H
I
K
L
M
N
O
x
q
v
u
t
3-EM SPACES
a
r
;
:
.
-
2-EM AND 3-EM QUADS
P
Q
R
S
T
V
W
X
Y
Z
J
U
&
ffl

A PIECE OF TYPE

A piece of type is a rectangular block of metal with a printing surface on top. The block is called the "body" and the printing surface is called the "face".

The height of the body is .918" and is known as "type-high". Although this dimension is not important to the designer, it is very important to the printer that all type be exactly the same height in order to print evenly and consistently.

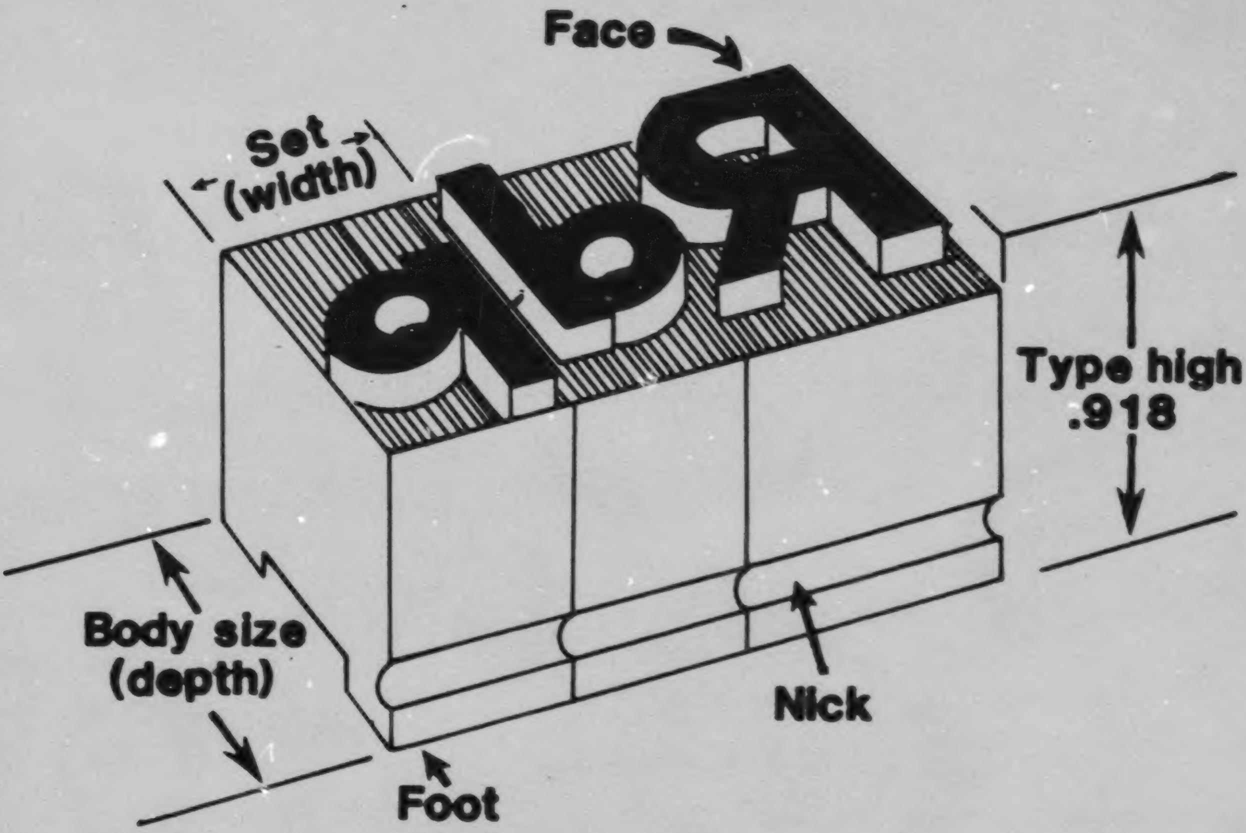

Face
Set
(width)
Type high
.918
Body size
(depth)
Nick
Foot

192

A PIECE OF TYPE

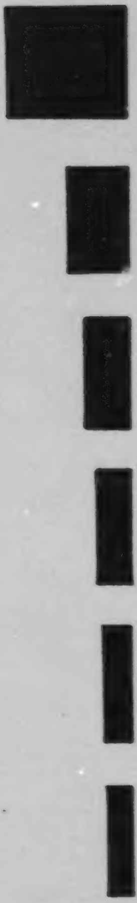
A piece of type is a rectangular block of metal with a printing surface on top. The block is called the "body" and the printing surface is called the "face".

The height of the body is .918" and is known as "type-high". Although this dimension is not important to the designer, it is very important to the printer that all type be exactly the same height in order to print evenly and consistently.


Face
Set (width)
Type high .918
Body size (depth)
Nick
Foot

192

EM QUAD AND ITS SUBDIVISIONS
WORD DIVISIONS



EM QUAD (square of point size)

EM QUAD ($\frac{1}{2}$ of an EM)

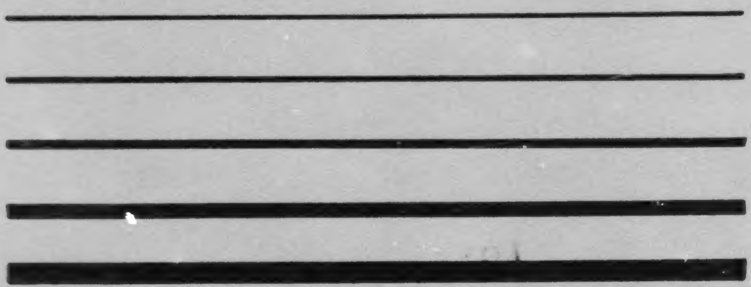
3-to-the-EM ($\frac{1}{3}$ of an EM)

4-to-the EM ($\frac{1}{4}$ of an EM)

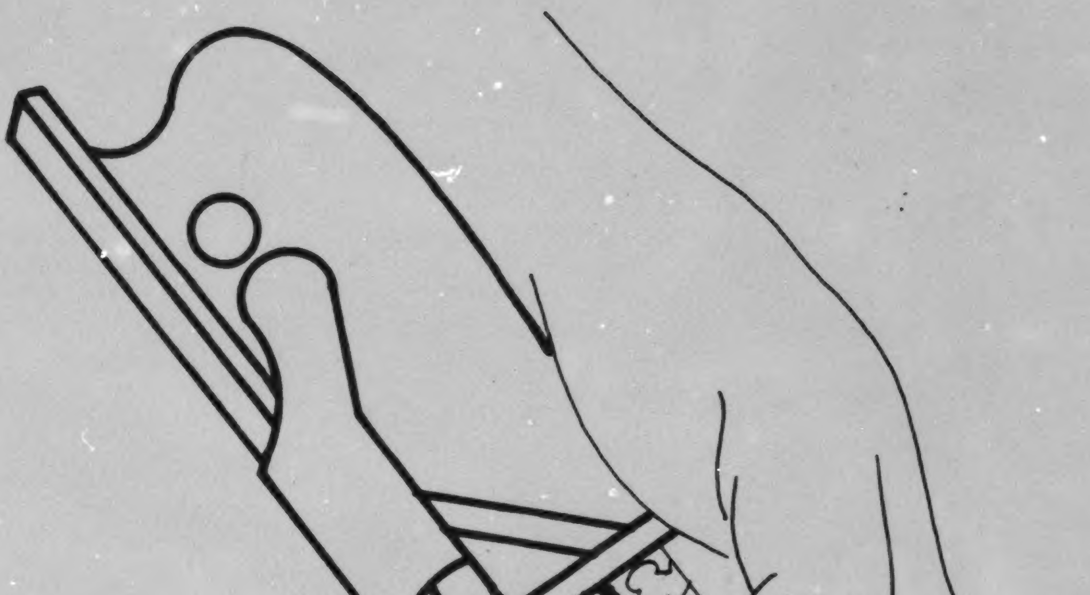
5-to-the EM ($\frac{1}{5}$ of an EM)

6-to an EM ($\frac{1}{6}$ of an EM)

VARIOUS LEADS FOR CREATING SPACE BETWEEN LINES OF TYPE

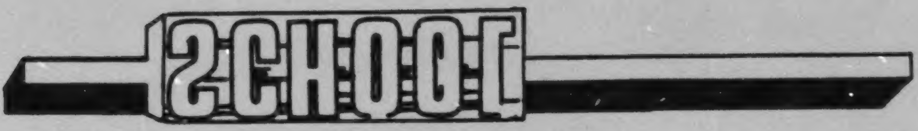


1 POINT
2 POINT
3 POINT
4 POINT
6 POINT

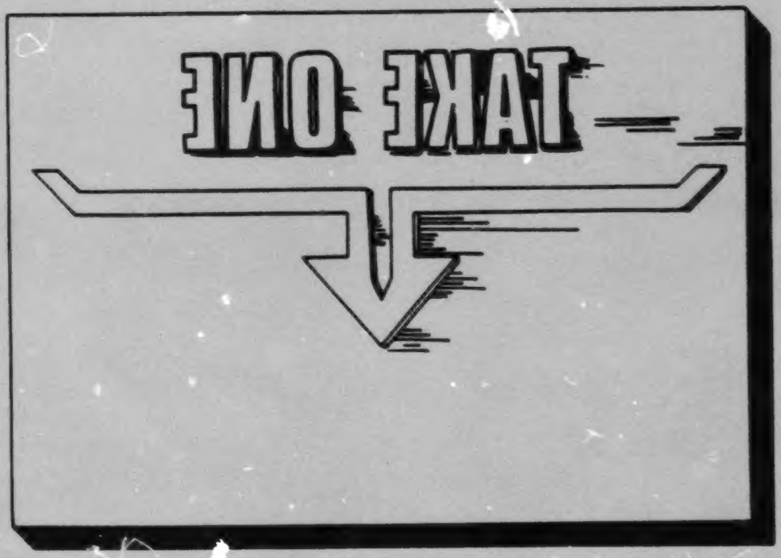


Composing stick with type

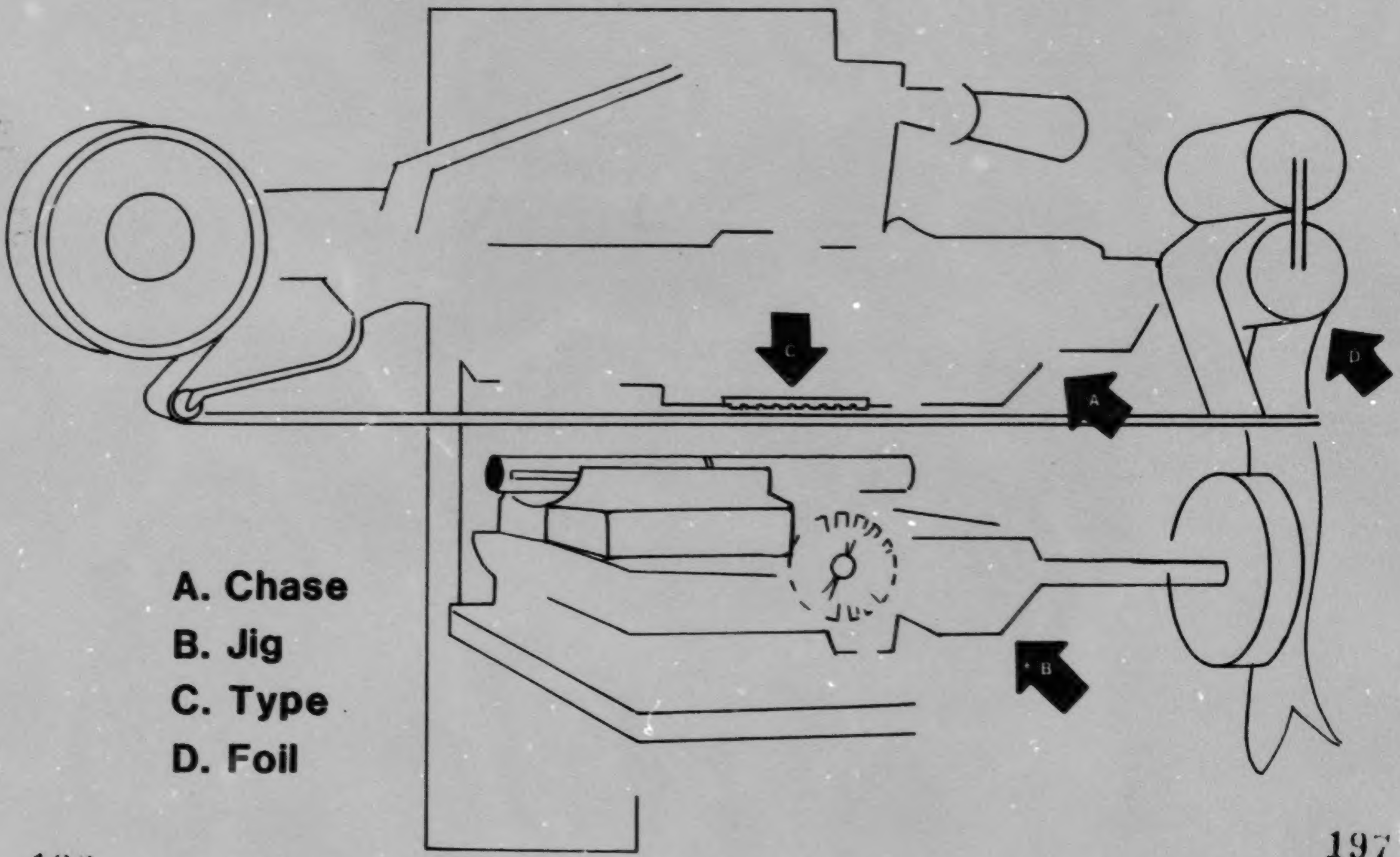
1. Ludlow slug



2. Magnesium die



BASIC PARTS OF A HOT STAMPING PRESS



A. Chase
B. Jig
C. Type
D. Foil

Procedure for Preparing the Platen Press

1. Move the grippers to the outer edge of the platen. Tighten the gripper nuts so that the grippers will stay clear of the type form.

2. Dress the platen. The amount of packing will vary with the nature of the form and the impression setting of each individual press. Be sure to start with thin packing.

3. Ink the press with an ink suitable for the paper you are using.

4. Use very little ink - just enough to get an impression.

5. Wipe the bottom of the form and place the chase in the press with the quoins at the top and right of the chase. A lock-up OK should be secured before the form is sent to press.

6. Sight the grippers to see that they clear the form, the bearers, if they are used, should also clear the form.

7. Pull an impression on the tympan draw sheet.

8. Determine the position of the sheet of paper to be run and place the gauge pins. The bottom pins should be approximately one-sixth the length of the ends, and the side pin about one-third the width of the sheet from the lower left corner. Adjust guides so the margins are correct with the edge of the press sheet.

9. Check gauges and gauge tongues to see that they clear the form.

10. Pull an impression and get a position OK. Check sheet for excessive impression.

11. Move grippers into position over the margins of the sheet.

12. Attach strings or gripper fingers if necessary. Make sure that they also clear the type form and gauge pins.

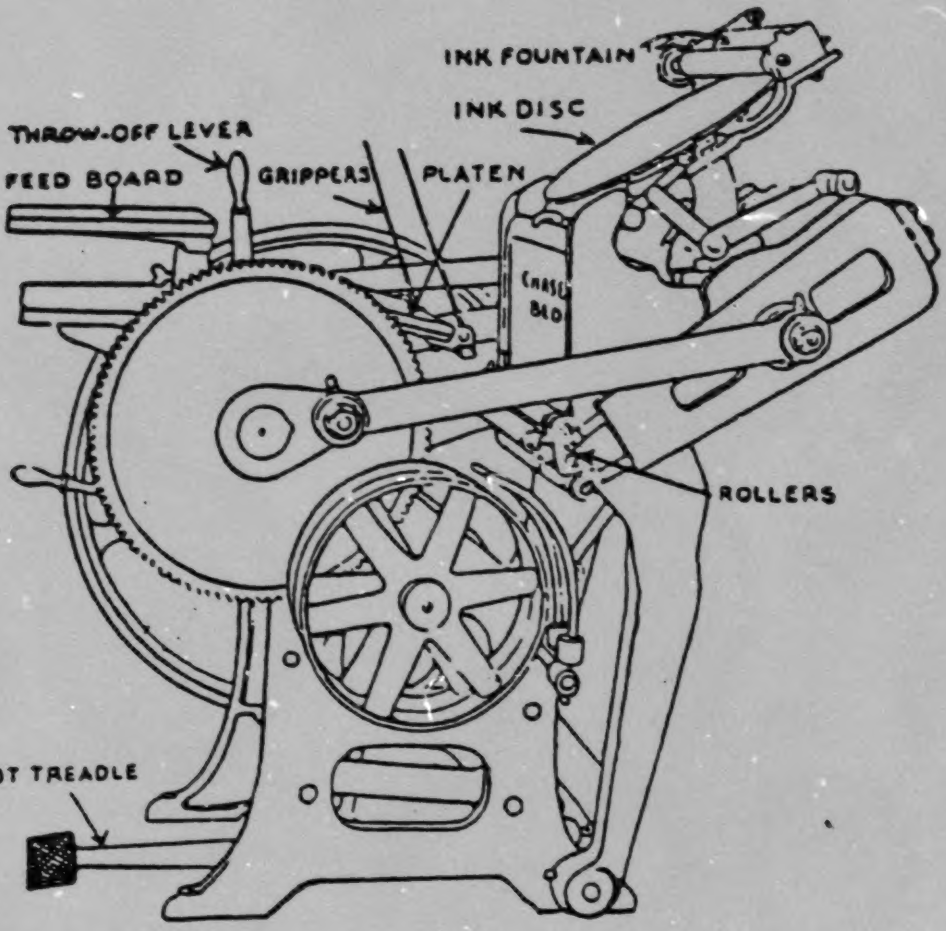
13. Wipe ink from the draw sheet with a clean rag dampened with solvent. Proceed with make-ready. After make-ready is completed, tap gauge pins down and run copy.

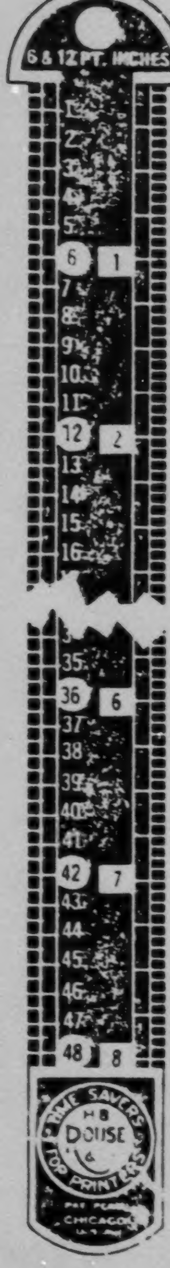
15. After the job is run, clean the press completely with the recommended solvent.

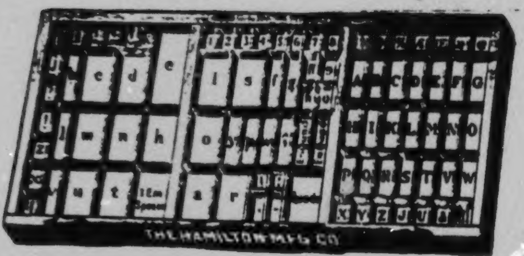
16. Unlock the chase and return all lock-up materials to their proper locations.

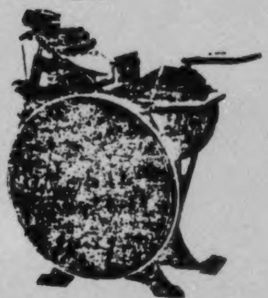
17. Distribute type.

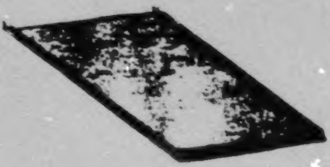
ILLUSTRATED INFORMATION SHEET ON PLATEN PRESSES

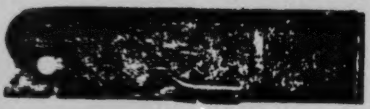

INK FOUNTAIN
INK DISC
THROW-OFF LEVER
FEED BOARD
GRIPPERS
PLATEN
CHASE BED
ROLLERS
FOOT TREADLE

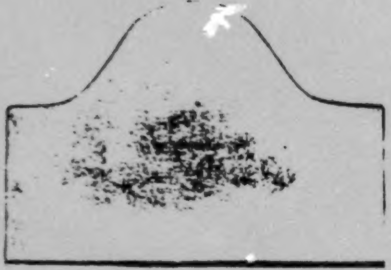

6 & 12 PT. INCHES
TIME SAVERS FOR PRINTERS
H B DOUSE
CHICAGO

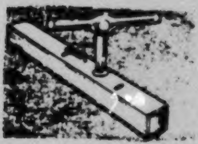

THE HAMILTON MFG CO

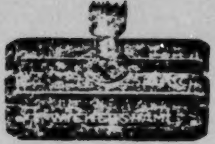


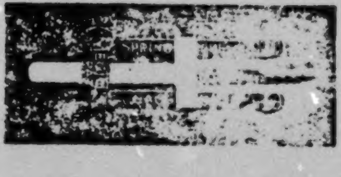


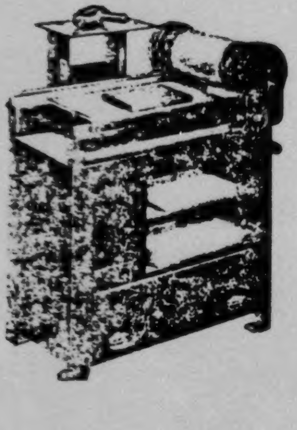


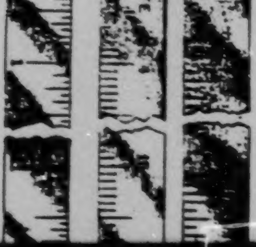




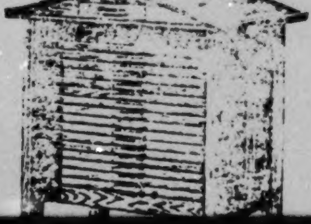




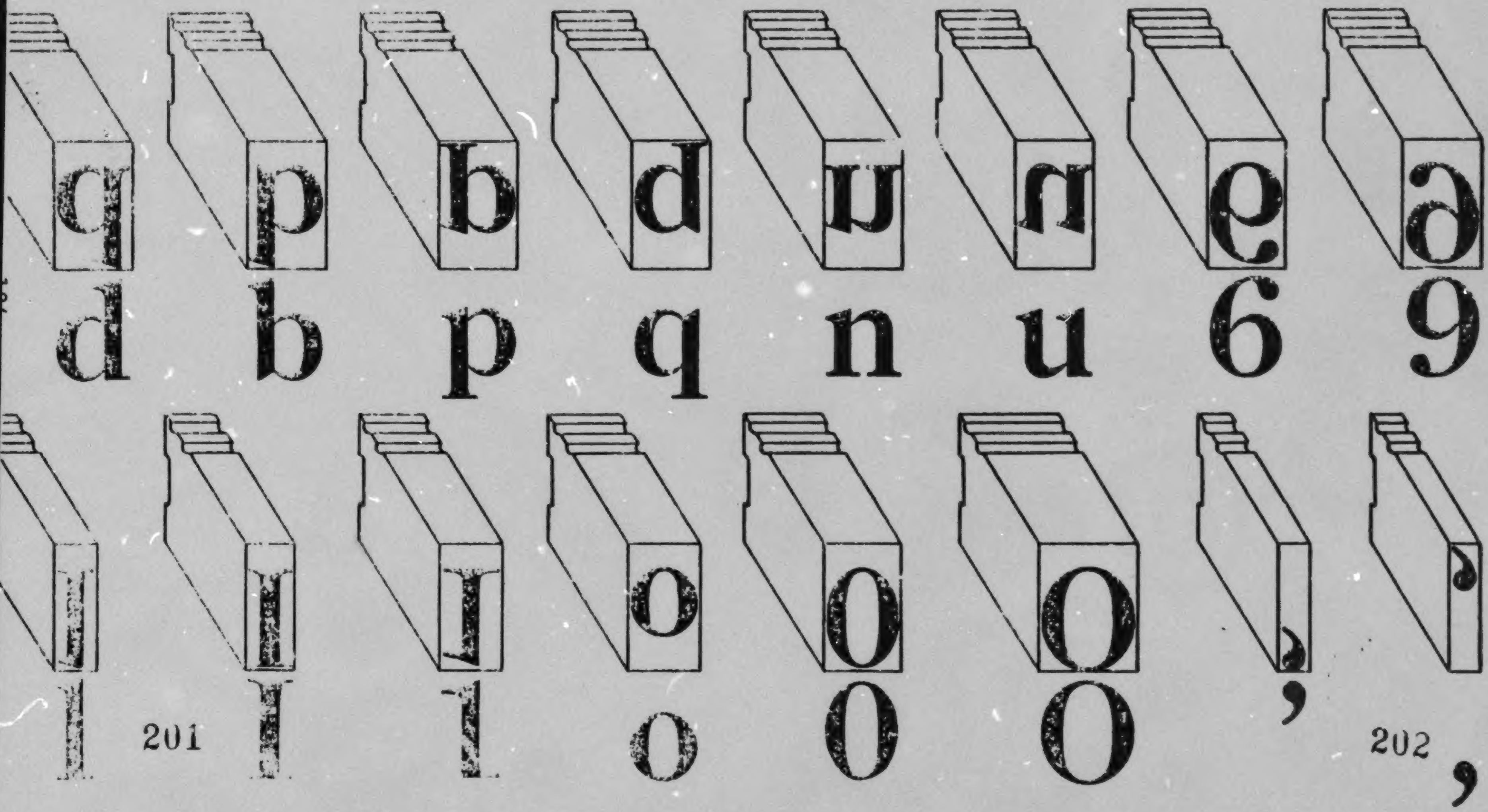




200



CHARACTERS DIFFICULT TO DISTINGUISH


d b p q n u 6 9
l I 1 o 0 O ’ ,

Student Activity #1

HOT STAMPING PROCEDURES

I. Objective:

You will take the material given and correctly complete the following tasks:

1. Set a line of type
2. Print line of type
3. Clean type and return all equipment to the proper storage area

II. Materials

Press
Type/composing stick
Foil
Item to be printed
Galley
Leads and word-spacing
String/galley locks

III. Procedures

1. With a composing stick and type case set a line of type by inserting type into the composing stick. Make sure all nicks on the type are towards the open end of the composing stick.

2. When type has been set, transfer it to a galley (shallow three sided tray) and place the desired space between the lines.

3. Tie up type form with string or galley locks.

4. Lock type into printing head (chase) of press; allow press to heat to predetermined printing temperature.

5. Place foil between type and jig.

6. Secure item to be printed in jig.

7. Have your instructor ok your operation and watch you operate the press.

8. Press type on item being printed.

9. Make corrections if necessary, e.g., dwell time, set up, temperature.

10. When run is completed, clean type and return type and other equipment to the proper storage place.

Student Activity #2

THE LETTERPRESS

PERSONALIZED STATIONERY

Student Learning Objectives

Learn the principles of letterpress printing including:

a. hand setting type and locking it up
b. taking a proof
c. cleaning type
d. making corrections
e. preparing, operating and feeding the letterpress
f. cutting paper to specified sizes
g. designing and cutting a box on the press
h. marbleizing the cover of a box

Each student will design some personalized stationery which will communicate to others a personal thought, expression, or self-concept. The stationery may be monogrammed or it may have the student's complete name and address. (If the student so desires, neither.) It will be a requirement however, that the student communicate some thought or expression on the stationery.

Administration Procedure

The stationery would be cut from 17" x 22" paper to 7" x 10" sheets and use #24 Monark envelopes. Each student will make 24 sheets of stationery and 24 printed envelopes. Each student will go through the design process of the stationery box. The jigs will be pre-made and provided by the instructor. Each student will marbleize the top of his own box and print the envelope heading in the center of the box.

General Teacher Outline

I. Assembling the image carrier
  A. Design the stationery, envelopes, and box
  B. Decide on a style of type
  C. Compose the type

D. Make a proof and correct errors
E. Lock up the type in a press chase
F. Cut paper to size
G. Clean type

II. Transferring the image carrier
A. Prepare the press
B. Marbleize top of box
C. Run off the stationery and envelopes

III. Packaging
A. Cut out box by use of press and jig
B. Glue box together

Materials needed per student

6 - sheets of 17" x 22" paper
24 - #24 monarch envelopes
Card showing California Job Case
String
1 - sheet of 17" x 22" poster board
Materials for platen press
Colored inks for marbleizing

Equipment needed per student

Type case
Composing stick
Glue
Marbleizing equipment
Chase, wooden furniture, quoints, and quoins keys
Platen press

HANDOUT SHEET FOR PERSONALIZED STATIONERY ACTIVITY

NOTE TO THE STUDENTS: Do each of the following items in the sequential order given and then check to the left of the number when complete.

____ 1. Receive from your instructor three sheets of 7" x 10" paper and one sheet of paper the same size as the envelopes.

____ 2. Carefully design the communication you want to relay to the receiver on your stationery. This could be a personal thought, expression, or self-concept. Along with this communication may be your monogram or your name and address. Develop three designs on the three sheets your instructor gave you and your return address on the envelope size paper. This information should be printed neatly in the appropriate area of the sheet you desire. Have your instructor put his OK on the one design you and he agree on as your best effort.

____ 3. From the display board that your instructor has shown you decide on the style of type you would like to use. The style should reflect the thought you are trying to convey.

____ 4. With a composing stick, type case, and a card showing the California Job Case, set a line of type by inserting a slug into the composing stick. Make sure all the nicks on the type are towards the open end of the composing stick. Always place a slug in the stick after setting the last line of type and a lead between each row.

____ 5. Secure the type together by tying string around the type and knotting it. Place type in the corner of the galley with the open end of the galley towards the cylinder of the proof press. Ink the type with a roller. Place a sheet of paper on top of the type and pull the cylinder over the type.

____ 6. Read the proof carefully, checking any errors with a pencil.

____ 7. Correct errors by using a makeup rule to change type.

____ 8. If necessary and desirable, center the type by increasing or decreasing the spaces placed at the beginning or end of each line. Check by making another proof.

____ 9. Lock up the type in a press chase as your instructor has shown.

____10. Prepare the press as shown by your instructor during the first two weeks of demonstration.

____11. Receive from your instructor six sheets of 17" x 22" paper. By using the math equation discussed by your instructor, determine how many sheets of 7" x 10" sheets can be cut from the larger 17" x 22" sheets. Set up the paper cutter with your group to cut paper to size. Have your instructor OK the set-up before the power is turned on. Cut your paper to size.

____12. Before the power is turned on to the press make sure that your instructor has OK'ed your set-up and that he will watch you operate the press. (Use wastepaper for the first few trial runs.)

____13. Run the cut paper through the press completing the paper part of your stationery.

____14. When the run is completed, clean type as shown by your instructor and return type and other equipment to the proper storing place unless part of the type can be used for the return address on the envelope. It is important that type be returned to the proper type case and be put in the correct compartments of the case.

____15. Your instructor has constructed a jig that can be placed in the press. It will cut and score the heavy paper you will use for the box that will hold your stationery in place. (For you to design and make this jig would take too much of your time.) Get a sheet of heavy paper from your instructor and each in your group cut your box out by using the jig in the press. Do it by hand, with the power off. Since the top and bottom of the box are identical, select one for the top.

____16. To marbleize the top of the box, go to the area which is set up for this process. On top of about an inch of clean water, drop several drops of colored ink. The colors and amount of each to be determined by you. Draw a nail comb over the surface to form the pattern desired. The lid top is then placed top side down on top of the water. Remove and let dry. Iron out wrinkles with a hand iron. (Make sure an extra sheet of paper is between the iron and the box lid.)

____17. For a return address on the envelopes, start with step 4 and put a check in the second space to the left of the number. Continue through step 13, substituting the envelopes for the paper. Secure 24 envelopes from your instructor.

____18. Center the box lid in the press so that the return address will be printed in the upper centered portion of the box lid. Get the instructor's OK. Print by hand power only.

____19. Put box together with glue, put envelopes on bottom with paper on top and turn and turn in for a grade.

SUGGESTED TEST

Introduction to Hot Stamping/Gold Stamping

1. Define hot type.

2. Hot stamp printing is also called ______________________________.

3. List basic equipment used in hot stamping.

4. List the two kinds of type and explain their differences.

5. Define:

   a. Dwell time____

   b. Leading____

   c. Foil____

   d. Slug____

6. The printing surface of a piece of type is called the

   ____

ANSWER SHEET

Suggested Test

1. "Hot type" generally refers to the melting and casting procedures which occur to make the type.

2. Gold stamping.

3. Press, type-composing stick, foil, item to be printed, galley, leads, galley locks.

4. Hand type--set by hand
Linotype machine--type set by machine

5. Define:

a. Dwell time: the amount of time pressure is applied to the stock that is being gold stamped is called dwell time.

b. Leading: metal strips of various thicknesses placed between the lines of type.

c. Foil: foil prepared with a special backing designed to adhere to the many different materials hot stamp printed.

d. Slug: a line of type set on a single piece of lead.

6. The printing surface of a piece of type is called the ____________________.

RUBBER STAMPING

OUTLINE OF CONTENT

I. What is Rubber Stamp Printing? Information Sheet #

A. A relief printing process; also known as flexographic printing.

B. Materials needed for construction of Rubber Stamp Plate

1. type / photo-engraving
2. matrix mold
3. rubber stamp gum
4. mounting base
5. rubber stamp press T.M. #

C. Basic Construction

1. plastic matrices are made from the type forms.

2. rubber plates are then made in the plastic molds by a special vulcanizing process in which heat and pressure are applied to the rubber stock.

3. rubber plates are mounted on various kinds of bases or directly on press cylinders, with double faced tape.

II. Origin of Rubber Stamp Printing

A. Letter Press Printing Information Sheet #

B. Types used in letter press T.M. #

C. Three types of presses used in letter press T.M. #

III. Construction of Rubber Stamp Plate T.M. #

A. Teacher will demonstrate Teacher Demonstration #

B. Student will construct rubber stamp plate
Student Activity #

IV. Common uses of rubber stamp

A. milk containers

B. gummed tape

210

C. bread and candy wrappers

D. paperback books

E. foil bags

F. wall paper

G. office stamps

    1. date

    2. name

Information Sheet #1

LETTERPRESS PRINTING

Letterpress printing is accomplished by means of type, of uniform height, assembled into groups, and locked up in a steel frame, or chase, for the printing press. Ink is applied to the faces of the types, and they in turn are pressed onto sheets of paper on which they leave their impression. The letters on types are cast in reverse, and the printing surfaces, or faces, of the letters stand out in bold relief above the type body.

There are different kinds of type, and their characteristics are determined by their differing methods of composition (the setting of type). There is (1) hand type, (2) type cast on slugs, (3) monotype composition, (4) woodtype, (5) brass type, which is used exclusively by bookbinders.

Information Sheet #2

FLEXOGRAPHIC PRINTING

Rubber Stamp Printing

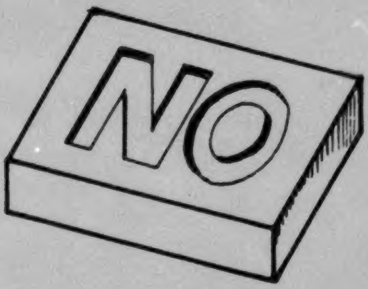
Flexographic printing, an extension from letterpress, is done with special ink and rubber plates, and is used in the printing of bags, wrappings, containers, and many different surfaces, such as burlap, glass, metal or plastic.

Flexography printing is used largely by converters and package printers. Many flexographic presses operate as units of elaborate package manufacturing machines.

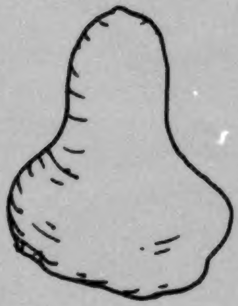
For small repeat design such as labels or candy wrappers, and for wall paper, decorative wrappings, and many kinds of roll printing, design rollers are used. These are rubber-covered cylinders on which a pattern of repeated or continuous design covers the entire circumference.

Rubber plates are used in special flexographic presses and for printing on hard or irregular surfaces difficult to print upon with type forms or metal plates. Plastic matrices are made from the type forms, and the rubber plates are then made in the plastic molds by a special vulcanizing process in which heat and pressure are applied to the rubber stock. Rubber plates may be mounted on various kinds of bases or directly on press cylinders, with double faced type.

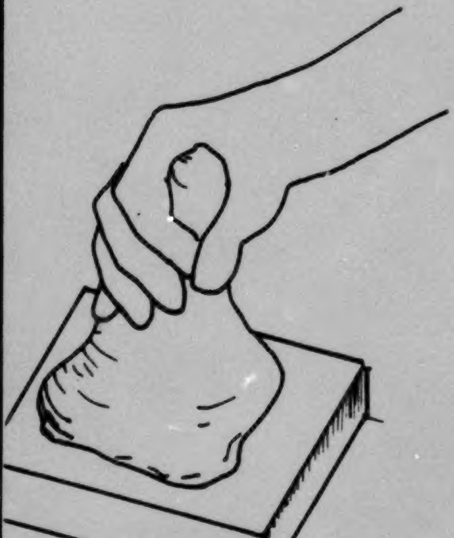
There are rubber stamp presses available that will enable you to produce quality rubber stamps without investing in a high priced machine. Some will make rubber plates for standing forms within the capacity of the chase.



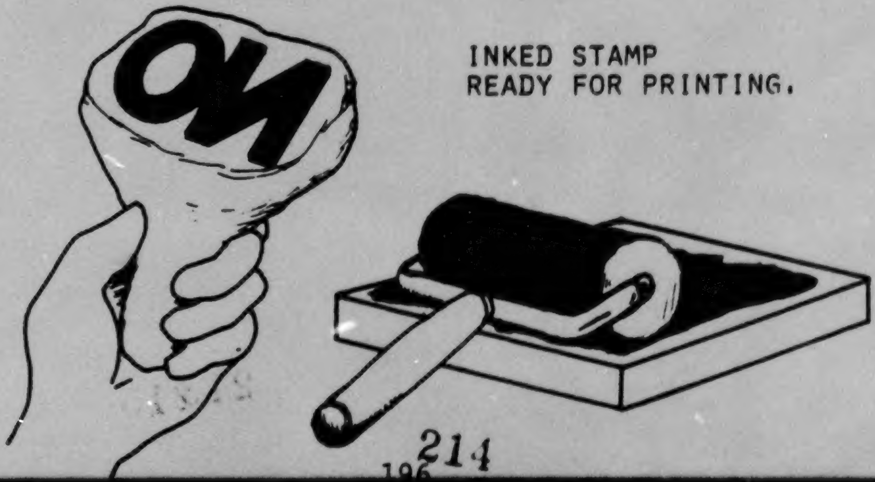
LINOLEUM BLOCK
ACTS AS MATRICE
OR MOLD WITH COPY
CUT BENEATH THE
SURFACE.



FIRM BUT MALLEABLE
CLAY (PLASTIZINE TYPE)
SHAPED TO FORM STAMP.

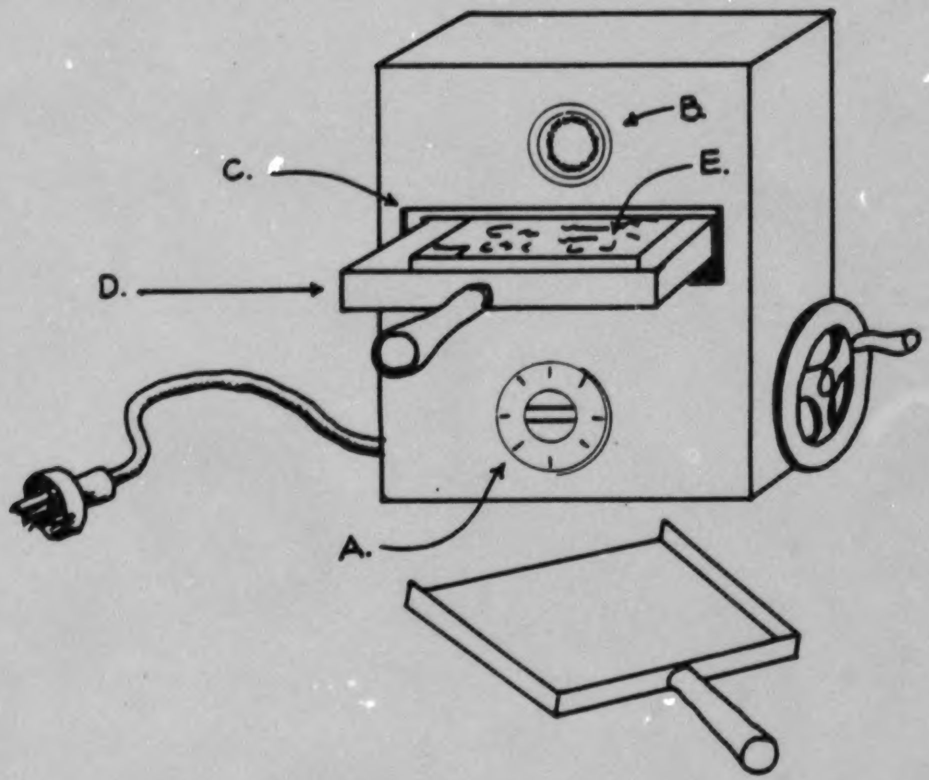


PRESS CLAY IN MOLD
FOR IMAGE TRANSFER.



INKED STAMP
READY FOR PRINTING.

RUBBER STAMP PRESS



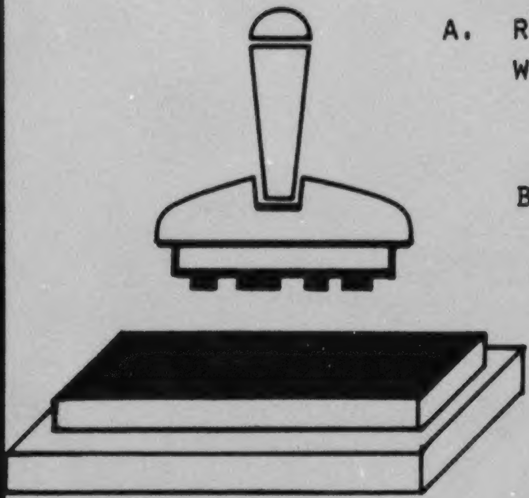
A. THERMOSTAT TIMER

B. TEMPERATURE GAUGE

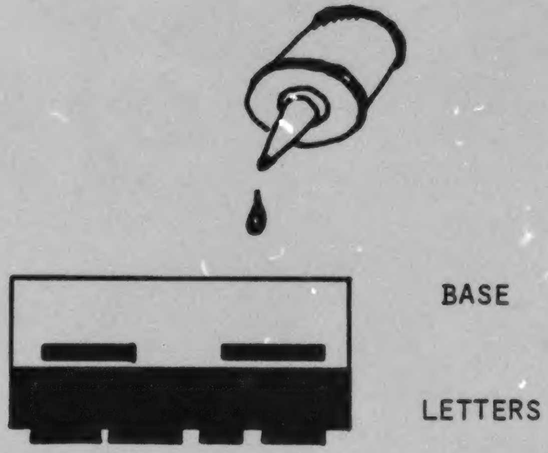
C. CHASE

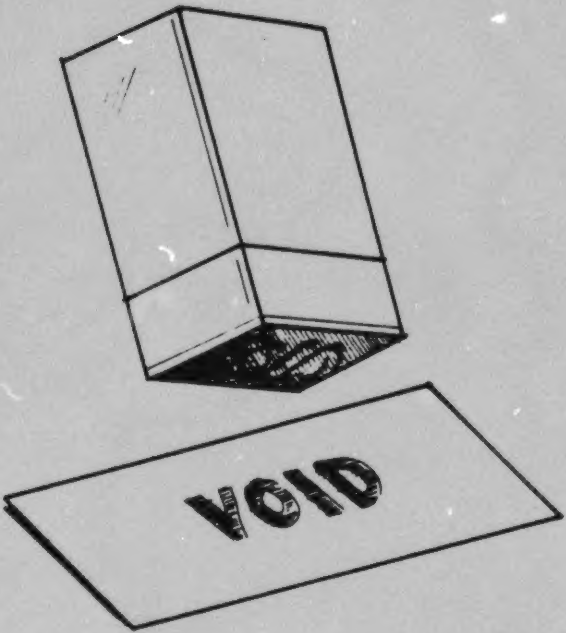
D. VULCANIZING TRAY

E. MOULDING RUBBER


BASE
LETTERS

A. RUBBER STAMP WITH INK PAD.


BASE
LETTERS



B. REFILLABLE STAMP WITH A SOFT PLASTIC BASE MATERIAL. THE INK IS FILTERED THROUGH TINY PORES OR OPENINGS, TO THE LETTERS. IT REQUIRES NO PAD.

Student Activity #1

SIMULATED RUBBER STAMP CONSTRUCTION

Objective: You will take the materials given and correctly complete the following task: simulate rubber stamp construction.

Materials:

linoleum block

modeling clay

ink/inking pad, glass or plastic

roller or dauber

cutting tools

paper

Procedures:

1. Transfer or draw original design on linoleum block.

2. Cut or engrave design in linoleum.

3. Make clay stamp to design specifications.

4. Press soft clay stamp into engraved linoleum block to get impression in relief.

5. Ink design on stamp with brayer or dauber.

6. Stamp or print.

SUGGESTED TEST

Rubber Stamp Construction

1. A rubber cast of a die or slug is called a _______________________.
2. What term is used to describe relief printing from a rubber plate?
3. List some common uses for the rubber stamp.
4. Describe the vulcanizing process.

ANSWER SHEET

Suggested Test

1. Stereotype

2. Flexography

3. Print on plastic films, foil bags, milk containers, gummed tape, bread and candy wrappers.

LITHOGRAPHY (OFFSET) PRINTING

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the offset printing process to include principles of lithography and offset; preparation of materials; type setting; and how lithography relates to the graphic communications industry.

CONTENT OUTLINE:

1. Principles of Lithography
   a. Process
   b. Types of Plates
2. Principles of Offset
   a. Process
   b. Types of Presses
3. Material Preparation
   a. Copy
   b. Screen
   c. Copy for offset
   d. Masking sheet
4. Type setting

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Attend classroom discussions covering lithography.
4. Do classroom demonstrations on operation and maintenance of the offset press.
5. Arrange field trip to local facility which uses offset style printing.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on lithography.

2. Discuss basic principles of offset printing.
3. Complete assigned lab activities.

OUTLINE OF CONTENT

I. Principles of Lithography

A. Lithographic process - A photo-mechanical process which prints from photographically prepared plates. There are no raised printing surfaces standing in relief above a lower non-printing background. Lithography is a planographic or surface printing process.

B. Plates - The image or design to be printed is placed upon the surface of the plate by transfer, by photo-mechanical process or by being drawn directly on it. The surface is chemically treated so that the areas designed to print will resist water but will receive the lithographic inks. The remainder of the surface which is dampened between each impression, will remain entirely uninked, and will make no print on the paper.

1. Direct Image Plate - This plate is characterized by the fact that the image to be printed is lettered, drawn, typed, etc., onto the plate surface itself by using special pens, pencils, ribbons, etc. This plate is made of paper with a special chemically treated surface. Because the image is put directly onto the surface of the plate, this plate does not need to be exposed or developed. (See Information Sheet #3) (Demo #1)

2. Indirect Image Plate - This plate is characterized by the fact that the image to be printed is put onto a layout sheet and is transferred electrostatically or photographically to the plate. This requires the plate to be both exposed and developed. These plates are made of various materials, including paper, plastic, aluminum and zinc.

II. Principles of Offset

A. The Offset Process - When ready to print the prepared plate is fastened around the plate cylinder of the lithographic press. After the metal plate is secured in the press it comes into contact with two sets of rollers. One set applies water which moistens all the surface except the area especially prepared for printing, while the other inks these areas, but leaves no ink on the moistened surface. As the plate cylinder turns it comes into contact with the blanket cylinder which is a metal cylinder covered by a rubber blanket. The ink is transferred from the inked areas of the plate to the blanket in reverse. As paper moves through the press it is forced between the blanket cylinder and the impression cylinder. The impression cylinder forces the paper against the blanket and the ink is 'offset' onto the paper.
(TM #)
(TM #)

B. Offset Presses - Offset presses come in many different types, styles and sizes. The two major types are sheet presses and web presses.

1. Sheet presses - Although these presses come in various sizes and styles, they are all characterized by the fact that paper is fed through the press one sheet at a time.

2. Web presses - these presses also come in a variety of sizes and styles and they are characterized by the fact that paper is fed through the press in one long continuous sheet ('web'). Web presses are used to print such things as newspapers, magazines, many catalogs, many books, and decorative wrapping papers.

C. Other types of presses

1. Flatbed - A press where the printing stone or surface rests on a "flattened" type of table.

2. Cylinder - Presses equipped with automatic dampening and inking rollers and a cylinder for carrying the paper.

3. Rotary - Consists of two cylinders that rotate in the same direction. A plate on one cylinder and paper on the other. (TM #4)

D. Operating the Offset Press (see Information Sheet #4)

III. Copy

A. Copy - Typed matter, pen drawings, ruled work and copy with no shading or graduation of tones are line copy.

B. Screen - Photographs, wash drawings, and all matter in varying density of tones are screen copy and they must be photographed through a half tone screen. This changed them into a pattern of dots, and makes them line copy.

C. Copy for Offset - The preparation of the plates in offset printing is esentially a photographic process, the treatment of the copy differs widely from the building of the type form for use in the letterpress. The copy is placed before the camera, a negative is developed, and the image is then transferred to the printing plate.

D. Masking Sheet/line up table - In order to arrange and position negatives together in a predetermined form, in a manner in which the image may be transferred to a printing plate, the films are mounted on a masking sheet, on a glass-topped light of line-up table, which is equipped with precision instruments for squaring, spacing and aligning the copy. No alteration can be made in positioning or spacing after the plate is made.

IV. Typesetting - The lettering which is photographically applied to offset printing plates is produced by several means: 1) much of it is set in metal type in letterpress composition plants which supply reproduction proofs for offset copy. Single display lines, masses of body type or completely made-up pages of matter are assembled for offset. 2) other methods known as cold composition are in use. Cold composition does not involve use of metal type. Most of the matter is produced or assembled by one of the general classes of type setting devices listed:

Photo typesetting or photo-composition machines; machines producing photographic strip lettering or film or paper for heading and display lines. Typewriting machines which set body matter, paper alphabets and clip book for which characters may be cut up and assembled as copy. Student Activity #1

Direct Image Plates

One of the simplest plates that can be used on the press is the direct image offset plate. This plate has advantages over some of the other types of plates. Basically, the plate is designed for short run prints--some say the maximum number of impressions is from 1000 to 5000. However, as any plate, the number of impressions that can be used or printed by the plate is greatly dependent upon the condition of the printing press and the experience of the operator.

Copy is put on the direct image plate by:

1. Typewriter - A carbon ribbon produces the best type for copy and produces more impressions.

2. A direct image pencil or pen. The pen or pencil can be used for drawings, handwritten copy or as an aid in layout. A non-reproducing pencil is to be used for laying out copy, since it does not print on the master.

An advantage of this plate is that it is probably the least expensive of any offset plate. It requires no developing, solutions or special care. It is subject to fingerprints, hand lotions, grease, etc.--something that the typist must be aware of. It should be handled by the edges, such as film is handled.

An offset printing job can be done with an offset press and the direct image plate. Although limited in the number of impressions, it can be preserved and saved.

A disadvantage of the plate is that is can be easily ruined, if not used as directed. It cannot be cleaned satisfactorily once it is on the press. Erasures can be made when typing or preparing the plate with a soft rubber eraser.

INDIRECT IMAGE PLATES

This type isn't made of metal or cast and is called two-dimensional because its surface is flat. Transfer letters are one kind of cold type. Cold type is usually used to make layouts from which offset plates are made.

PHOTOCOPYING

Taking a picture of a good sample copy of material that has already been printed and then using this photograph to make an offset plate and reprint the material.

MECHANICAL COMPOSITION

Layout or arrangement of different varieties of cold type which are pasted up to form a page that is ready to copy photographically.

a. Clip art
b. Hand-drawn lettering
c. Stencil scribing
d. Pre-printed type
e. Typewriting

The IBM Selectric has various typing elements which contain different styles of type that may be interchanged to produce the desired lettering.

PHOTOTYPESETTING

Photographic display lines (usually hand-set)

Photographic display type in composed on machines which are sometimes capable of setting limited text matter, besides setting display lines. The details produced are in very fine detail and the finished work can be on either film or paper, as negatives or positives. In actual use, the display typesetter is fitted with a particular type font (a form of film negative that contains a complete set of transparent letters and characters). This font is placed in the machine above the printing location and between the exposure lamp and sensitized film font for the desired characters. Then the photo paper is developed, fixed, and dried and is ready to be mounted.

One example of a machine that composes photographic display type is the headliner. Some models of the headliner produce single lines of type, while others can produce up to five lines of type. The headliner can produce large advertisements, posters, and other material; and uses circular discs about the size of a phonograph record for its type font. This disc fits between the film exposure light and the threaded roll of photographic print paper or film. Composition is done by rotating the selector knob in either direction until the desired character appears in the selector window. Then the operator depresses the print key which automatically centers the selected character, advances the print paper or film, and makes the exposure of that character. When the desired amount of composition has been accomplished, the strip of paper is cut, and is then automatically sprocketed through the machine's developing, fixing, and washing tanks. It emerges as a finished print, ready for paste-up.

Photographic page composed type

A number of machines are available which photocompose entire pages of typed matter on film (either as negatives or positives). These machines are used in the production of newspapers, books, and magazines because the type produced photographically is sharper than reproduction of hot metal.

The linofilm is a complete photocomposition system embracing make-up as well as typesetting and correction. The system is made up of four units: the keyboard unit, the photographic unit, the corrector, and the composor. The keyboard unit produces a punched tape and a typewriter record. This tape contains all the information necessary for the fully automatic operation of the photographic unit. The operator can select any one of eighteen (18) different font grids and each font is available in six different point sizes. Once the punched tape is prepared it is fed from the keyboard unit into a reading head. The machine will then set th matrial and expose it in the photographic unit as recorded on the tape. Upon completion, the film or paper is automatically advanced into a cassette which can then be taken to the darkroom for processing. In the corrector, film requiring correction is placed in one gallery and film containing the corrected lines is placed in an adjoining gallry. A dial is then set to the desired type of correction and when started the machine automatically removes the incorrect lines and welds the correct ones in place. The linofilm composor performs two functions: makeup and enlargement. The composor re-photographs the gallery, line by line, altering its position to conform to a layout and, if necessary, enlarging it. This allows the operator to make-up into a single photographic film positive any type film material fed into the composor.

Information Sheet #4

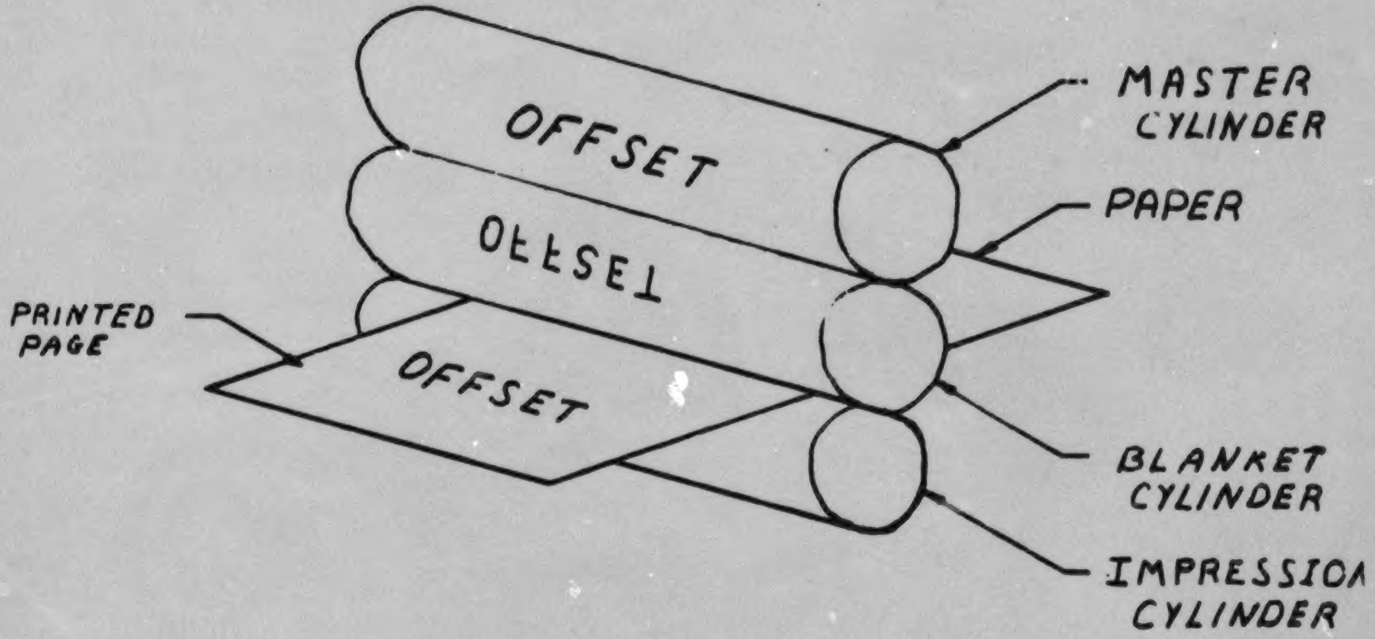
Operation of the Offset Press

Operation of the offset press involves the successful setup and adjustment of the basic systems of the press. Specific techniques for individual presses differ; assistance may be required from the manufacturer or operational manuals.

The general process is as follows:

1. Load paper and set up paper feed system.
2. Adjust paper registration system.
3. Adjust paper delivery system.
4. Adjust fountain system.
5. Adjust inking system.
6. Install image carrier (the plate) on plate cylinder.
7. Turn on main power switch.
8. Engage inking and fountain form rollers.
9. Contact plate to blanket cylinder.
10. Turn on paper feed mechanism.
11. Make necessary image position changes.
12. Maintain adjustments of all systems as job is printed.
13. Clean the press.

THE OFFSET PROCESS


MASTER CYLINDER
PAPER
OFFSET
OFFSET
PRINTED PAGE
OFFSET
BLANKET CYLINDER
IMPRESSION CYLINDER

Terms and Definitions.

A. *Sheet-fed press* A press in which the paper enters the printing unit as a single sheet.

B. *Web-fed press* - A press in which the paper enters the printing from a continuous roll.

C. *Multi-color press* - A press capable of printing more than one color during one pass through the press.

D. *Letterset press* A press which combines features of the offset and letterpress presses.

Basic Theory of Offset Printing.

A. The theory of offset printing is based on the fact that grease and water do not mix.

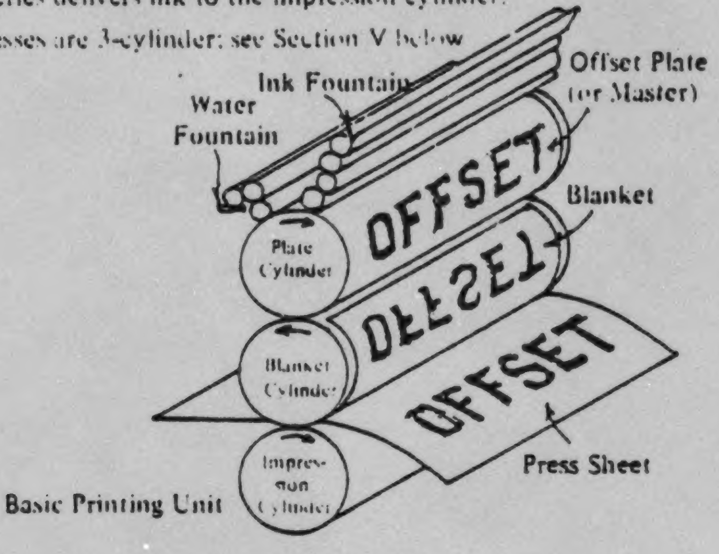
  1. The image-bearing areas of the exposed, processed, and moistened plate are receptive to ink (which is slightly greasy) but repel water.
  2. The clear areas of the moistened plate are receptive to water but repel ink.
  3. Therefore, the plate can be flat (the image area is level with the clear area).

B. *Offset printing* is also called *lithography, photo-lithography, photo-offset lithography, offset lithography,* and *photo-offset*

C. The basic printing unit is usually a series of 3 cylinders: *plate cylinder, blanket cylinder,* and *impression cylinder* (See Fig. 1).

  1. A series of rollers delivers water for dampening the impression cylinder
  2. Another series delivers ink to the impression cylinder.
  3. Not all presses are 3-cylinder; see Section V below

Figure 1


Ink Fountain
Offset Plate (or Master)
Water Fountain
OFFSET
Blanket
Plate Cylinder
OFFSET
Blanket Cylinder
OFFSET
Impres-sion Cylinder
Press Sheet
Basic Printing Unit

D. Most offset presses consist of five separate systems. See Fig. 2 and Section IV below.

THE FIVE OFFSET PRESS SYSTEMS

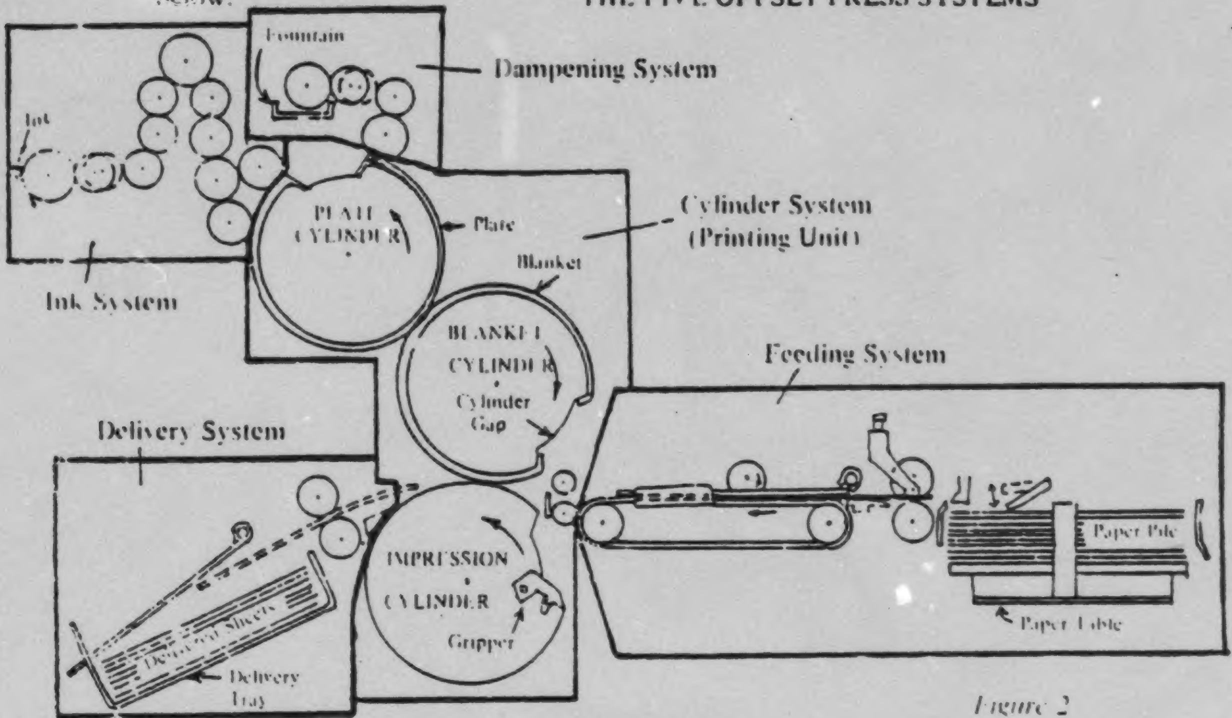

Fountain
Dampening System
Ink
PLATE CYLINDER
Plate
Cylinder System (Printing Unit)
Blanket
Ink System
BLANKET CYLINDER
Cylinder Gap
Feeding System
Delivery System
Delivered Sheets
Delivery Tray
IMPRESSION CYLINDER
Gripper
Paper Pile
Paper Table

Figure 2

Kinds of Presses.

A. *Sheet-fed presses* range from small "office" duplicators to large, high-volume precision presses. Each one picks up one sheet of paper at a time and passes it through the press to a delivery tray.

B. *Web-fed presses* tend to be larger presses often used for large publications. Each one is fed by a large roll (or rolls) of paper. After being printed, the roll may be cut into sheets, cut and folded into signatures, or rewound onto a roll.

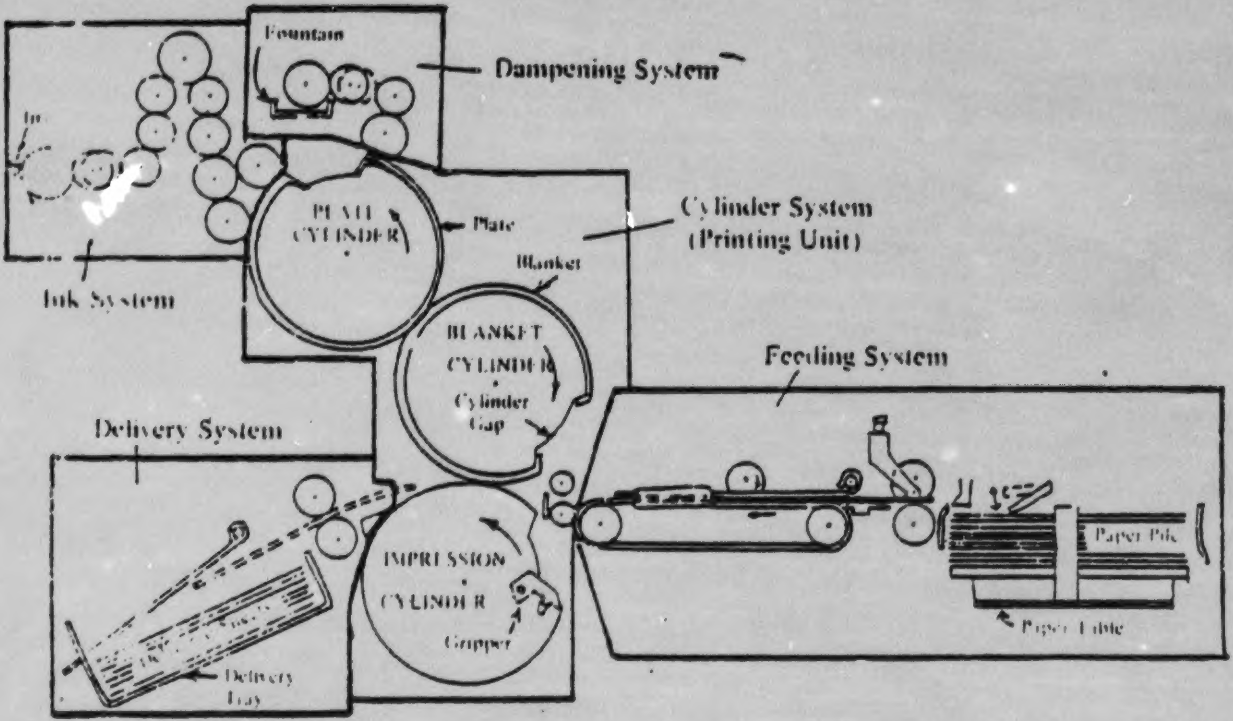
C. *Small offset presses* (often called duplicators) are generally restricted to single color work.

D. *Multi-color presses* are those precision presses (either sheet-fed or web-fed) which contain up to six separate printing units so that 1, 2, 4, 5 or 6 colors can be printed on one pass through the press.

Major systems of a Sheet-Fed Press (Review Fig. 2 above).

A. *The feeding system* is usually air-and-vacuum-operated.

   1. An air blast separates the top sheets of paper in the paper table (or feed tray).


Fountain
Dampening System
Ink
Ink System
PLATE CYLINDER
Plate
Blanket
Cylinder System (Printing Unit)
BLANKET CYLINDER
Cylinder Gap
Feeding System
Paper Pile
Paper Table
Delivery System
IMPRESSION CYLINDER
Gripper
Delivery Tray

INFORMATION SHEET ON THE A.B. DICK MODEL #320 OFFSET PRESS

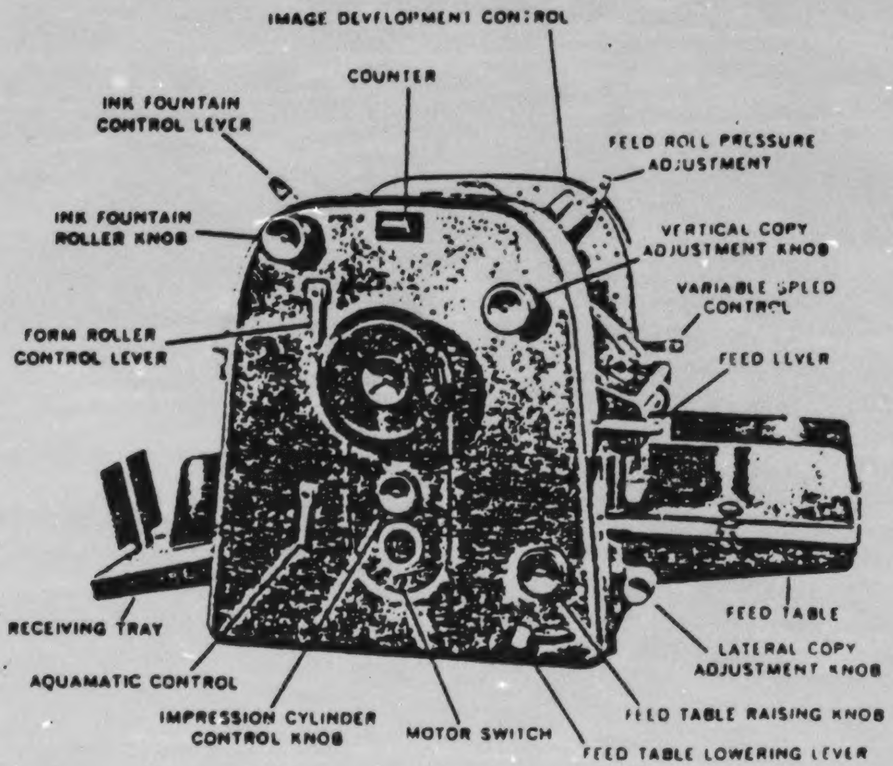
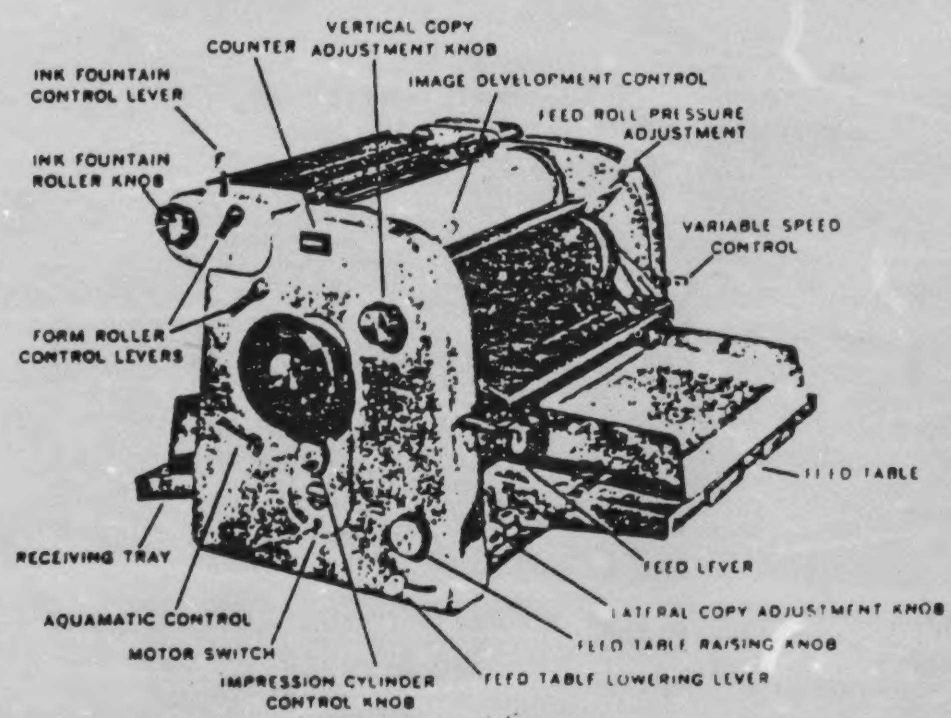
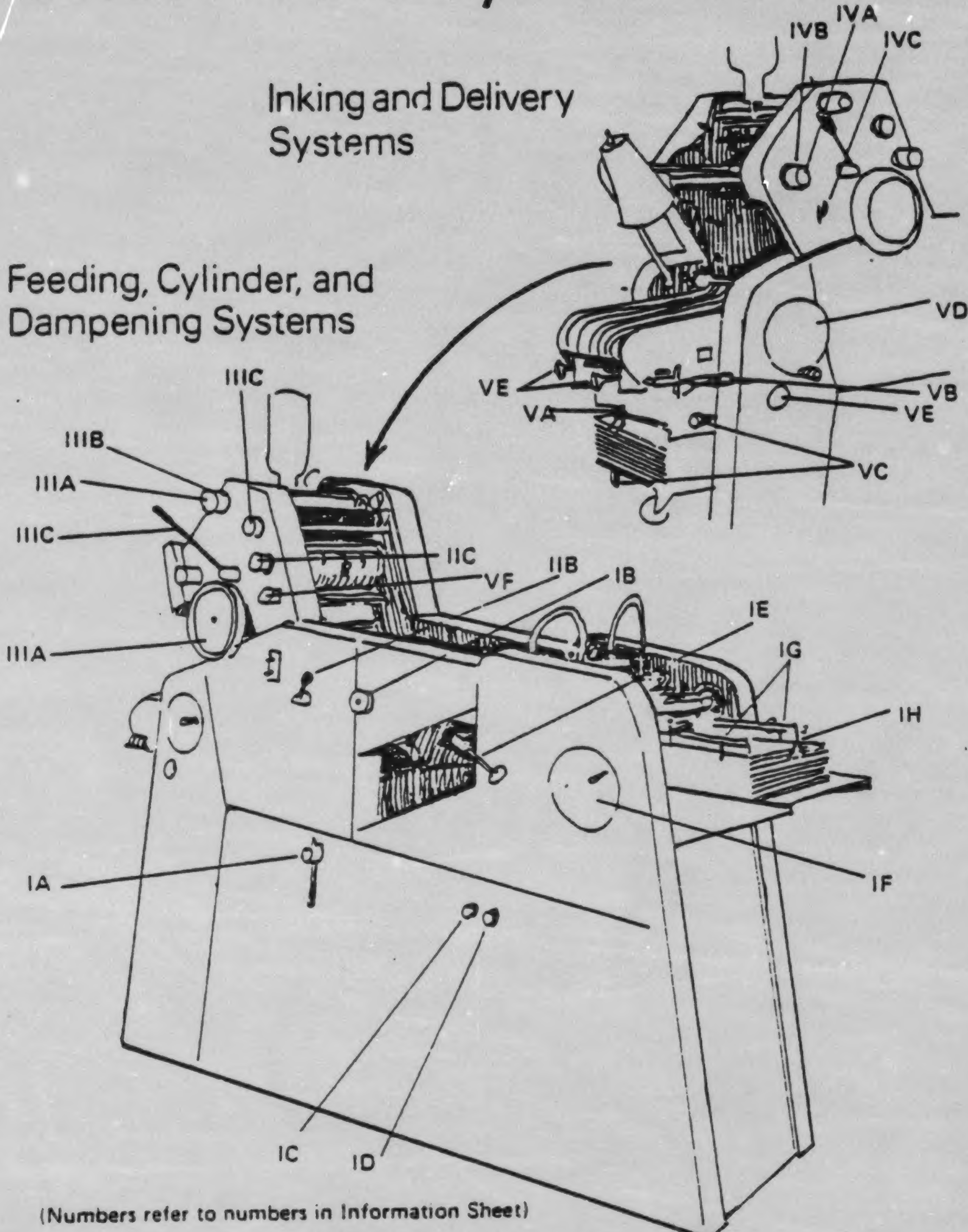


IMAGE DEVELOPMENT CONTROL
COUNTER
INK FOUNTAIN CONTROL LEVER
FEED ROLL PRESSURE ADJUSTMENT
INK FOUNTAIN ROLLER KNOB
VERTICAL COPY ADJUSTMENT KNOB
VARIABLE SPEED CONTROL
FORM ROLLER CONTROL LEVER
FEED LEVER
FEED TABLE
RECEIVING TRAY
LATERAL COPY ADJUSTMENT KNOB
AQUAMATIC CONTROL
FEED TABLE RAISING KNOB
IMPRESSION CYLINDER CONTROL KNOB
MOTOR SWITCH
FEED TABLE LOWERING LEVER

MODEL 321


VERTICAL COPY ADJUSTMENT KNOB
COUNTER
IMAGE DEVELOPMENT CONTROL
INK FOUNTAIN CONTROL LEVER
FEED ROLL PRESSURE ADJUSTMENT
INK FOUNTAIN ROLLER KNOB
VARIABLE SPEED CONTROL
FORM ROLLER CONTROL LEVERS
FEED TABLE
RECEIVING TRAY
FEED LEVER
LATERAL COPY ADJUSTMENT KNOB
AQUAMATIC CONTROL
FEED TABLE RAISING KNOB
MOTOR SWITCH
FEED TABLE LOWERING LEVER
IMPRESSION CYLINDER CONTROL KNOB

Offset Press System Controls



IVB
IVA
IVC
Inking and Delivery Systems
Feeding, Cylinder, and Dampening Systems
VD
VE
VB
VA
VE
VC
IIIC
IIIB
IIIA
IIIC
IIC
VF
IIB
IB
IE
IIIA
IG
IH
IA
IF
IC
ID

(Numbers refer to numbers in Information Sheet)

PRESS OPERATION PROCEDURES

1. Placing plate on the press
2. Setting guides for paper
3. Setting delivery and rolls
4. Mix fountain solution
5. Wet plate
6. Turn on water
7. Turn on ink rollers
8. Make trial run and adjustments
9. Press wash-up

Information Sheet #5

Cleaning the Offset Press

Objective:

To demonstrate clean-up procedures for the offset press in order to have the machine ready for use the next day.

Procedure:

1. Remove the printing plate. (Preserve the plate if it is to be used again.)

2. Remove fountain solution.

3. Check condition of dampening rollers. Clean or replace, if necessary.

4. Remove and wash the ink fountain.

5. Use cleaner sheets to clean all ink rollers.

6. Remove and clean all ink rollers than can be removed.

7. Reassemble all parts removed in the clean-up procedures.

8. Clean the frame of the offset press.

9. Secure the night latch on the machine.

Information Sheet #6

PROCESSING

In this context "Processing" means the conversion of artwork, photograph and type reproduction into a form in which they can be printed.

Though the printing medium may differ--letterpress, photolithography, photogravure, silk-screen--the processing of any but the simplest elements for these must involve the use of photography at some stages. Thus, there are certain factors common to all print media processing. For example, since orthochromatic film material is commonly used, but is not sensitive to process cameras and may be used for instruction marks and construction lines which are not intended to be reproduced. Again, where full color reproduction is required, any of the media processes will involve the use of color filters to separate the image photographically in blue, red, yellow and black plates which will overprint to give a full color result. So it can be seen that preparation of material for processing does not differ greatly between one medium and the other.

Conditions to establish at the outset are:

a) If the medium is letterpress, is the type to print the metal direct or from a plate made from a type impression?

b) If the medium is photolithography, photo-gravure or silk-screen, must the material for processing be submitted with all elements reduced to the same scale or can the required reduction merely be indicated on overlays?

Apart from establishing the above conditions, the preparation of work for processing is similar whatever the medium. The word "plate" when used in this context is taken to refer to the physical product of the letterpress, litho or gravure processing techniques, and even, by extension, to the silk screen process (though of course in this case the product is a screen and not a plate).

Student Activity #1

Description: During this time the instructor should demonstrate the setup, operation, and cleanup of an offset press. Students will then run electrostatic direct image or photo masters they prepared in the previous lesson.

Student Activity #2

Description: During this time the instructor should demonstrate the various composing devices and the preparation of a paste-up. On the second day, the preparation of the various image carriers should be demonstrated. It is recommended that halftones be left out of this segment and a direct image or electrostatic master be made that involves only line copy. Sample projects: memo pad (see Activity 1 sheet following), Christmas greeting card, stationery, one page information sheet.

Student Activity #3

Objective:

You will take a direct image offset plate and complete the following tasks:

1. Write your name on the plate with a reproducing pencil.

2. Sketch an object with a non-reproducing pencil. Go over the outline sketch with a reproducing pencil.

3. Type a line across the master with a manual typewriter and a regular fabric ribbon.

4. Type the same line again using a typewriter with a carbon ribbon.

5. Have the teacher use your plate to reproduce several copies.

6. Make notes on the result of each instrument you used on the plate after it has been printed.

Materials:

Direct image offset plate

Non-reproducing pencil

Reproducing pencil

Reproducing pen

Manual typewriter

Student Activity #4

Offset Printing

Memo Pad

Student Learning Objectives

Learn the principles of offset printing including:

a. producing an image carrier
b. transfer of the image
c. operating the offset press safely
d. designing the communicative material
e. working effectively producing communication material
f. padding, binding, and trimming communication material for distribution

Each student will make a design layout for a memo pad which should communicate to the receiver at least three things about himself: (1) a line drawing depicting sender's occupation or character, (2) the sender's name, and (3) the sender's motto or slogan.

General Teacher Outline

I. Assembling the image carrier

A. Prepare the copy for the copier.

1. Select type sizes from the shop style sheet and use the Headliner or Selectric typewriter to compose the type for the pad.

2. Complete the art work.

3. Make a paste-up of the job.

4. Make the offset plate on an electrostatic copier.

5. Have design prepared so it will fit on an 8-1/2" x 11" sheet of paper or a sheet half that size.

II. Transfer the image

A. Prepare the offset press.

1. Prepare the inking mechanism.

2. Prepare the dampening system.

3. Make initial inking and dampening.

4. Install plate on the press and make feeder adjustments.

5. Make register board adjustments.

6. Adjust the impression.

7. Make the trial impression.

8. Adjust the margins.

9. Adjust delivery.

B. Run the job on the offset press.

III. Packaging - pad and trim the copy

Materials needed per student

13 - sheets of 17" x 22" paper (choice of colors)

Padding compounding

Electrostatic plate

Paste-up materials

Composing machine supplies

Equipment needed

Shop type style sheet

Offset press

Headliner

T square

Triangle

Ruling pen

Paper cutter

Padding press

Selectric (IBM) typewriter

242

HANDOUT SHEET FOR MEMO PAD ACTIVITY

NOTE TO THE STUDENTS: Do each of the following items in the sequential order given and check to the left of the number when complete.

The operations involved in making a photographic offset plate for the memo pad and printing it on the offset press are technical processes.

____ 1. Make a design layout for a memo pad using paper furnished by the instructor, size 5-1/2" x 8-1/2". The sheets of this pad should communicate at least three things to the receiver: (a) your name, (b) a line drawing depicting your occupation or character, and (c) your motto or slogan.

____ 2. After receiving the instructor's OK on your design layout, select type sizes from the shop style sheet and, using the Headliner, compose the type for the pad.

____ 3. Refer to your layout. Your layout is your guide for making the paste-up. Arrange the type according to the layout. Draw in the area where your picture will be placed.

____ 4. When the layout is complete, present it to the instructor so it may be approved before it is sent to have an electrostatic plate made.

____ 5. Familiarize yourself with the safety rules for operating the offset press.

____ 6. Receive from your instructor thirteen (13) sheets of 17" x 22" paper. Using the math formula for paper cutting that was discussed by the instructor, determine how many sheets of 5-1/2" x 8-1/2" sheets can be cut from the larger 17" x 22" sheets. Set up the paper cutter with your group to cut the paper to size. Have the instructor OK the cut before you cut the paper to size.

____ 7. Etch and mount the plate on the offset press and print 100 sheets for your memo pad.

____ 8. Place several memo pads in the padding press. Place chipboard between each pad and on top and bottom. Jog the sheets together and tighten down the press. Apply the padding compound.

____ 9. After the padding compound dries (one hour), trim the memo pad in the paper cutter.

____10. Turn the memo pad in for a grade.

SUGGESTED TEST

True or False

1. ____ There are no raised printing surfaces in offset or lithographic printing.

2. ____ In the offset process, the plate is dampened then inked to each revolution.

3. ____ Line copy contains many gradation of tones.

4. ____ Direct image plates are more expensive than most other offset plates.

5. ____ Apprenticeship programs in the printing industry usually last 1-2 years.

1. List three types of presses.

    a.

    b.

    c.

2. List the five states that have most of the printing industry.

    a.

    b.

    c.

    d.

    e.

BLOCK PRINTING (Intaglio/Gravure)

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the history of block printing; some of its uses; different methods of block printing; the equipment involved; and how block printing relates to the overall graphic communications industry.

CONTENT OUTLINE:

1. History of block printing
2. Method of block printing
    a. Wood cut
    b. Linoleum cut
    c. Wood engraving
    d. Plastic engraving
3. Uses
4. Equipment

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Attend classroom discussions covering block printing.
4. Do classroom demonstrations as required.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on block printing.
2. Discuss the basic principles of block printing; different methods of printing and the application of uses of block printing.
3. Complete assigned lab activities.

OUTLINE OF CONTENT

I. History of Block Printing

A. Earliest Development - 1100 years before beginning of Christian era.

B. Early Uses of Block Prints - Greeting cards, book covers, calendars, playing cards, pages of books, murals. Information Sheet #1

II. Methods of Block Printing

A. Wood Cut - Print made in fairly soft wood cut plankwise.

B. Linoleum Cut - Print made from a design cut in a piece of linoleum, mounted "type-high" for press.

C. Wood Engraving - Print made from plastic acetate on mylar. (Transparency #1)

D. Plastic Engraving - Print made from plastic acetate on mylar. (TM #)
(Student Activity Sheet #)

E. Terms and Definitions (Information Sheet #2)

III. Uses of Block Printing (Information Sheet #1)

A. Greeting Cards

B. Book Covers

C. Calendars

D. Playing Cards

E. Wall Paper

F. Textile Prints

G. Wall Hangings

H. Posters

IV. Basic Equipment

A. Wood or Battleship Linoleum Block - Wood or the one kind of linoleum suitable for block printing.

B. Knife - Tool used for cutting wood cut on lino design.

C. Gouges - Tool used for cutting wood cut design.

D. Steel Square - Tool used for measuring and layout work.

E. Tracing Paper/Carbon Paper

F. Pencil

G. Paper to Print On - Most paper is appropriate for printing.

H. Block Print Ink - Ink used for a printing block.

I. Brayer/Hand Press - Handroller or press used to transfer the ink from inking slab to block.

J. Glass/Inking Slab - A piece of glass or plastic used to roll ink out on. (Information Sheet #2) (Transparencies #2, #3)

V. Wood/Lino Cut Procedures

A. Transfer Design - Tape design face down on block and trace all lines of drawing with pencil.

B. Cut Design - Cut design with knife, leaving raised areas to be printed in black.

C. Ink Design - Apply ink to the raised areas.

D. Print Design - Place paper on ink surface of block and print.

(Transparencies #2, #3, #4, #5) (Student Activity #1)
(Demonstration #1)

VI. Acetate Film Etching Procedures

A. Transfer Design

B. Cut Design

C. Ink Design

D. Print Design

(TM #) (Student Activity #)
(Information Sheet #)

Information Sheet #1

HISTORY OF BLOCK PRINTING

Eleven-hundred years before the beginning of the Christian era the Chinese had reproduced many of their picture-writings in woodcut. This block art spread into Korea and Japan, where later it was developed to perfection.

Block printing on paper developed from the practice of printing designs on textiles from wooden blocks, which was a common practice throughout the Middle Ages.

Paper was not commonly used to print on before the early fifteenth century.

Early uses of the woodcut were greeting cards, initial letters, book covers, and playing cards.

The woodcut served the purpose of mural paintings which later developed into the manufacture of wall paper.

Before the invention of moveable type, the pages of books were printed from single blocks of wood with the text and illustration cut in relief.

Block printing is not confined to small work. Hand block wall paper and large wall hangings with hand-blocked printed designs are being used by interior designers.

While wood block printing probably lends itself as a better medium of expression for the experienced artist and craftsman, for the student, linoleum has many advantages over wood. Linoleum block printing is simple and lends itself to many applications. Linoleum is reasonable in cost, can be engraved with simple tools and printed with little equipment. It is also possible and practical to mount the engravings on blocks of wood, type high, and print on a flat bed press as many as 2,000 impressions before the linoleum begins to break down.

All prints may be divided into two large divisions: first, prints as a work of art, and second, all kinds of commercial prints. Under the first heading would be the wood and lino block prints, etchings, lithographs, mezzotints, and acquatints. The second division would embrace photographic prints and all types of photoengraving such as line cuts, halftone engraving and all forms of process color work.

Information Sheet #2

TERMS AND DEFINITIONS

Apple, pear, cherry, sycamore, beech, sweetgum - Woods used in wood cut printing.

Battleship linoleum - The one kind of linoleum suitable for block printing.

Black and white print - Only one block is used from which design is cut and block rolled up in black ink.

Block printing - When the wood/linoleum is removed inside and about the design leaving it standing in relief about the block.

Boxwood - Wood most commonly used by wood engravers.

Brayer - Handroller used to transfer the ink from inking slab to block.

Burgin - Tool used by wood engravers.

Burnisher - Tool used in wood cut or lino printing to rub impression onto paper.

Chisels - Tools used for cutting wood cut or lino design.

Gouges - Tools used for cutting woodcut design.

Graven - Engraving tool.

Inking slab - Piece of glass or plastic to roll ink out on.

Knife - Tool used for cutting wood cut or lino design.

Lino-cut - Used as a modern substitute for wood for the cutting and making of block prints, the infant offspring of the woodcut. Economical, easily obtained and prepared and because it has no grain the tools cut with ease in all directions.

Tint tool - Engraving tool.

Type-high - The body height of a piece of type if 0.918. It is very important to the printer that all type be exactly the same height in order to print evenly and consistently.

Woodcut - A print made in fairly soft wood cut plankwise.

Wood engraving - A print made from a design cut in a piece of hard wood with a cross grain. The image making methods resemble intaglio engraving, but printing is done in the same manner as for the woodcut.

TECHNIQUES OF GRAVURE PRINTING

DESCRIPTION OF LESSON

In this lesson the student will learn and practice the basic method of preparation and transfer of an image by the gravure method.

BEHAVIORAL OBJECTIVES

1. Each student will demonstrate the ability to assemble an appropriate image carrier for the gravure method.

2. Each student will successfully make a drypoint etching of his chosen gravure message.

3. Each student will present his idea in such a manner as to communicate effectively with the selected receiver.

4. Each student will know the advantages and disadvantages of gravure printing.

5. Each student will discuss orally the process of gravure printing comparing it to the three major printing processes.

LESSON OUTLINE

I. History of Process

A. Originated in the 15th century as a high quality process of reproduction used by artists.

B. Developed in the 20th century as a high quality printing process used for extremely long runs.

C. The method uses copper plates, printing from a depressed surface, which is opposite of letterpress.

II. Gravure printing process

A. Type and copy is prepared similar to letterpress and offset methods.

B. All copy photographed through halftone screen onto a carbon tissue film.

C. Carbon tissue is adhered to the cylinder and the cylinder is developed in an etching bath.

D. The whole cylinder is inked and ink is removed from the high parts of the cylinder by the doctor blade.

E. Image transfer can be made on either sheet fed or web fed processes.

F. The gravure process is used on the following types of materials.

1. money

2. stamps

3. magazines

4. newspaper supplements

5. catalogs

6. foil wrappers

G. The high cost of preparing the plates limits the process to extremely long runs, where high quality is desired; as a result, gravure printing encompasses only 15 to 20 percent of the printing business in the United States.

III. Advantages and Disadvantages

A. Advantages

1. Faster than letterpress

2. Cylinders may last as long as a million impressions

3. Cheaper paper stock can be used

B. Disadvantages

1. Suited only for long runs - 25,000 or more.

2. Relatively expensive process

IV. Copperplate engraving

A. Discovered by Maso Finiguerra in Italy - 1446

B. Engraving done largely by hand

C. Principle much the same as gravure

D. Slow and costly but etiquette demands use for wedding announcements, calling cards, greeting cards, etc.

E. More expensive per piece than any other process

F. Thermography - imitation engraving

1. Printed on letterpress

2. Involves use of powder on wet ink which is raised by application of heat

3. Much cheaper than engraving but produces almost the same effect

GRAVURE PRINTING

Gravure printing (also called intaglio) prints from an image carrier with the printing areas depressed (the opposite of letterpress). The depressed areas act as ink wells and when printing stock is contacted to them under pressure a printed product results. It is used for treasury notes and stamps because of the difficulty of producing counterfit materials using the same process. Gravure presses are of two types, sheet fed and web fed.

Information Sheet #4

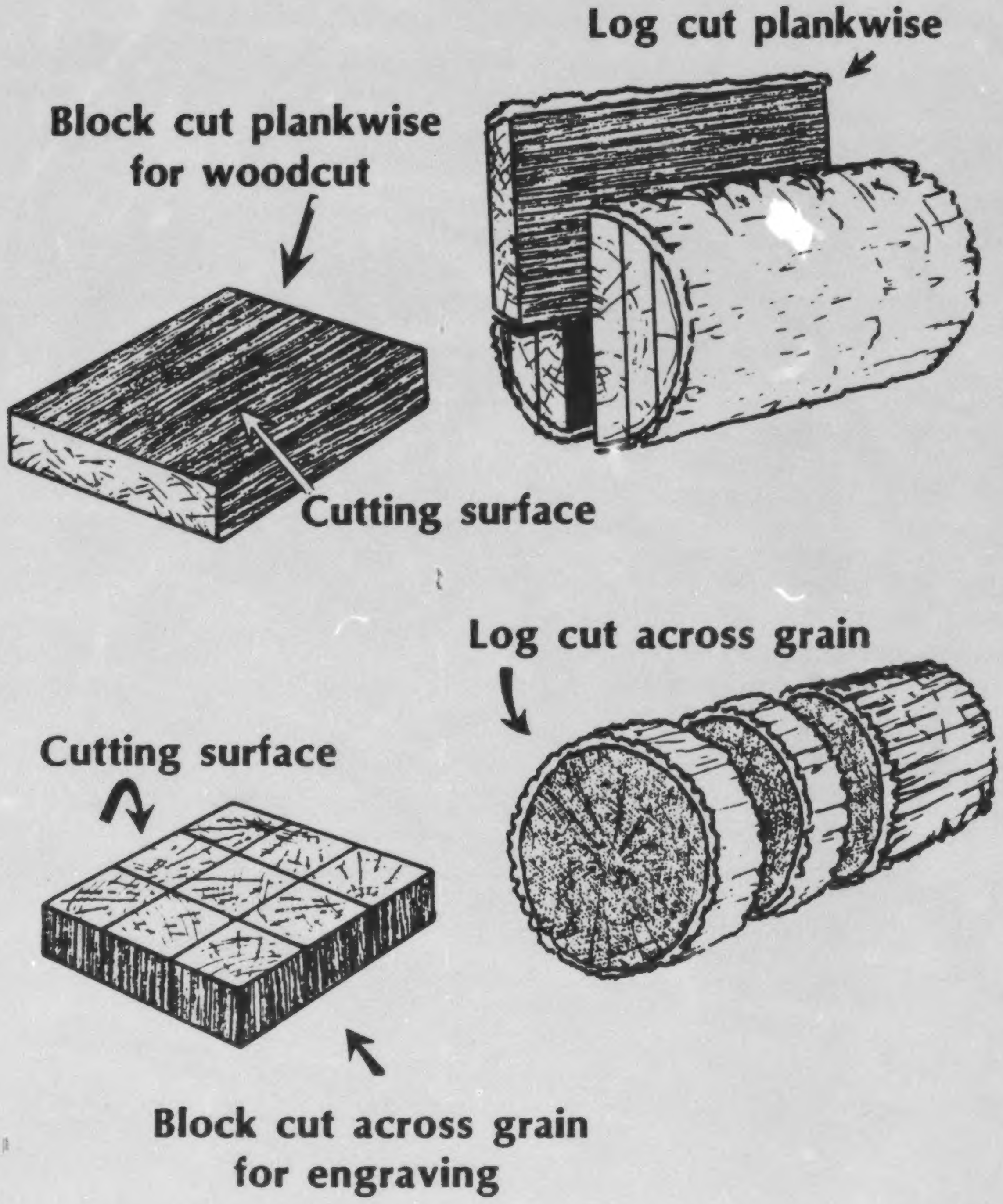
INTAGLIO PRINTING

Wrinkle Printing

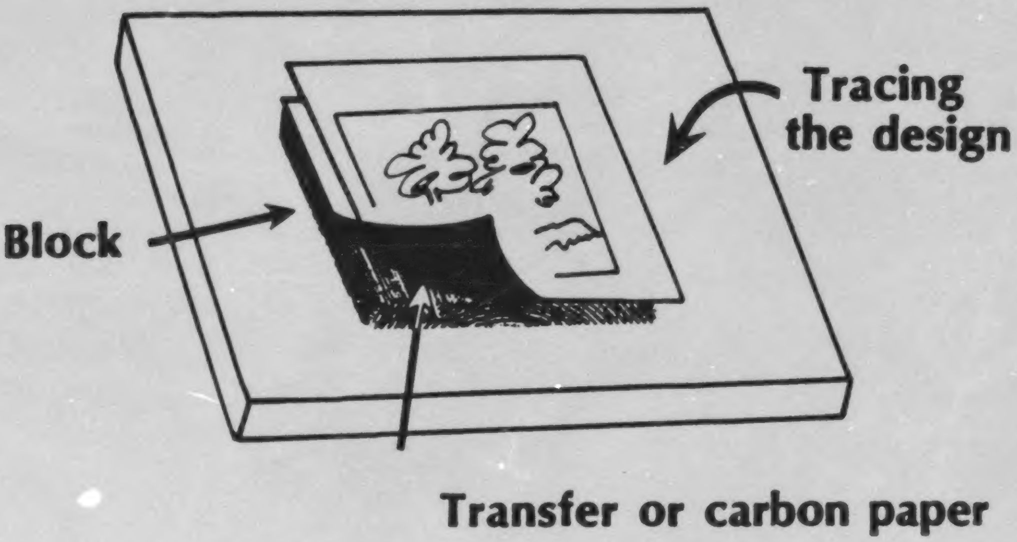
There are many unconventional methods and materials to prepare intaglio plates. For figurative prints and rough lettering you might try wrinkle printing. The essence of the process is this: a plate is coated with black wrinkle finish spray paint, which produces a rough texture that can hold etching ink in many tiny wells, evenly distributed across the surface. Portions of the rough surface are coated with white lacquer in varying thicknesses. The thicker the lacquer, the more the wells are filled up and the plate evened out. This means that parts of the plate become semi-smooth or very smooth. When the plate is coated with etching ink and wiped, the roughest parts, untouched by the white lacquer, will hold the greatest amount of ink and will print black. The semi-smooth parts will lose some ink in wiping, but will retain enough to print varying shades of gray. The very smooth parts will be wiped clean and will print white.

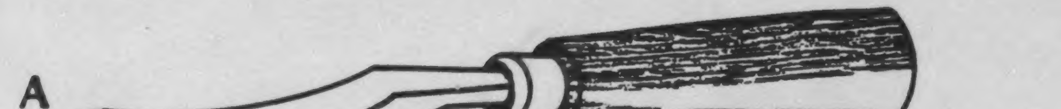
The plate is printed by the usual intaglio process. The inked plate is covered with a sheet of damp paper and passed through the etching press under pressure. When the paper is peeled away it literally pulls the ink from the wells or grooves. This process might be termed dry or direct, since they do not involve acids.

Since some budgets will not allow for the purchase of a press for use in a unit on intaglio printing, you might try to find an old hand run washing machine wringer, which can serve as an etching press.


Log cut plankwise
Block cut plankwise for woodcut
Cutting surface
Log cut across grain
Cutting surface
Block cut across grain for engraving

TRANSFERRING THE DESIGN TO BLOCK

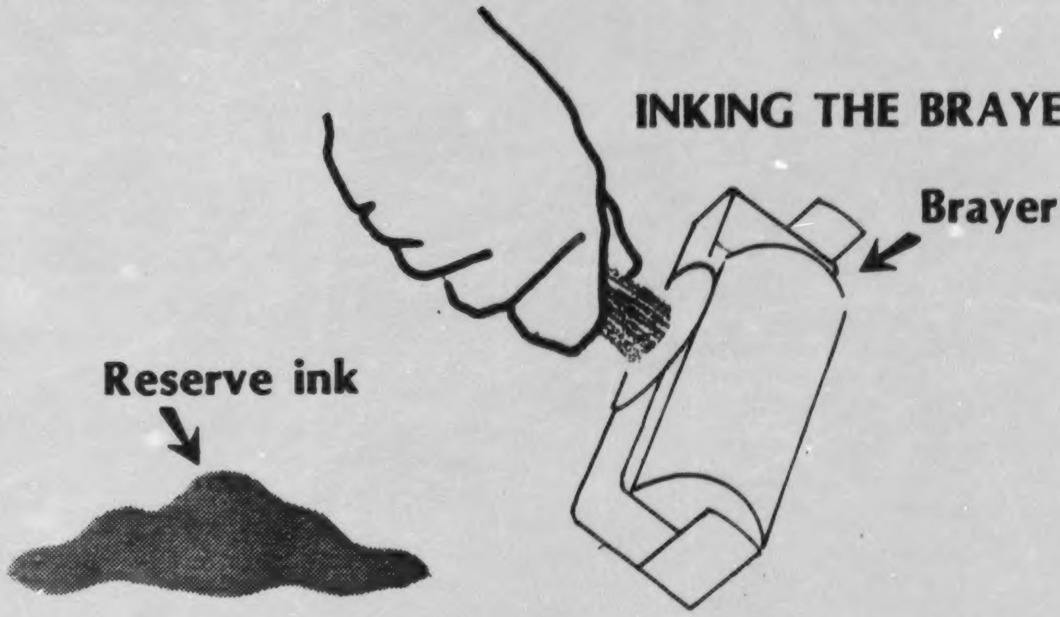

Tracing the design
Block
Transfer or carbon paper



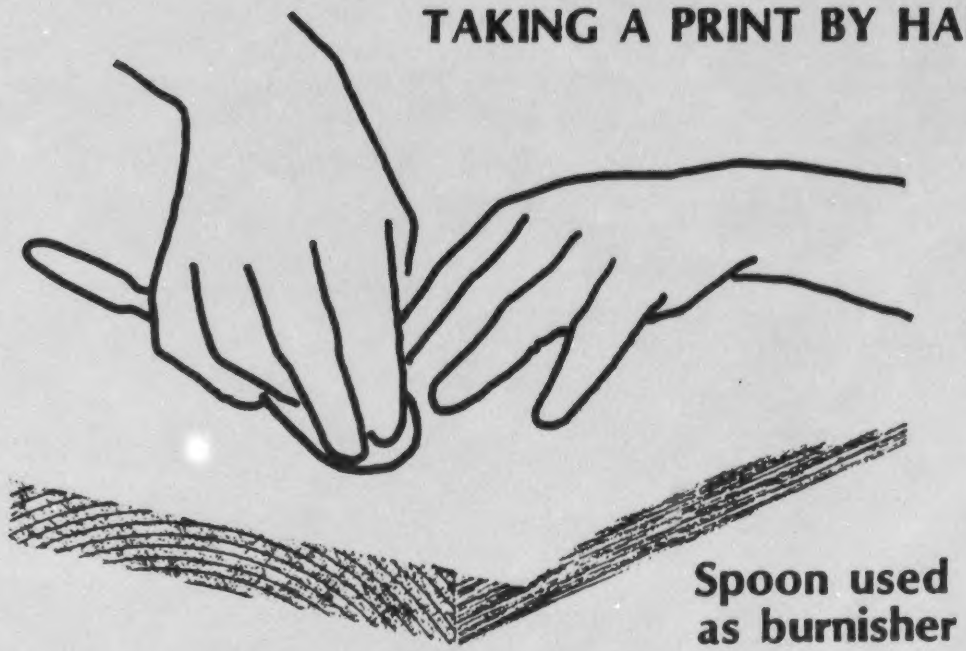
A-Gouge with handle
B-"C"shape gouge
C-"U"shape gouge
D-"V"shape gouge
E-Chisel
F-Cutting knife

TOOLS USED FOR
CUTTING WOOD AND
LINOLEUM BLOCKS

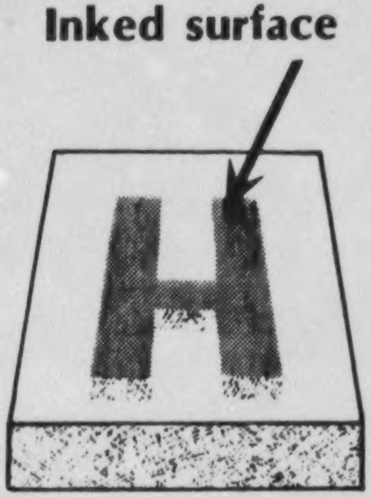
INKING THE BRAYER


Brayer
Reserve ink

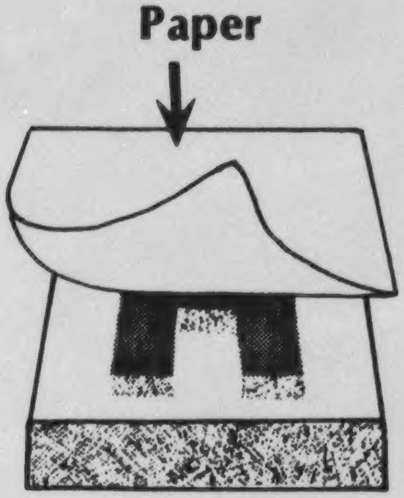
TAKING A PRINT BY HAND


Spoon used
as burnisher

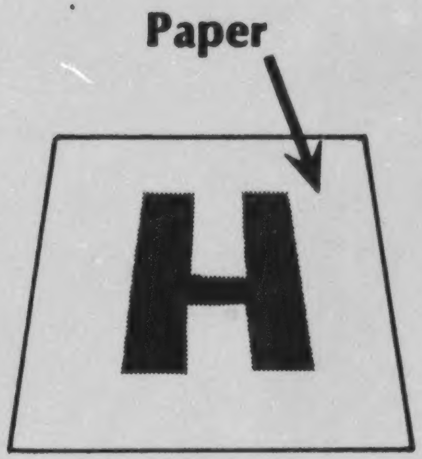
BLOCK PRINTING


Inked surface
H

Block showing design in relief

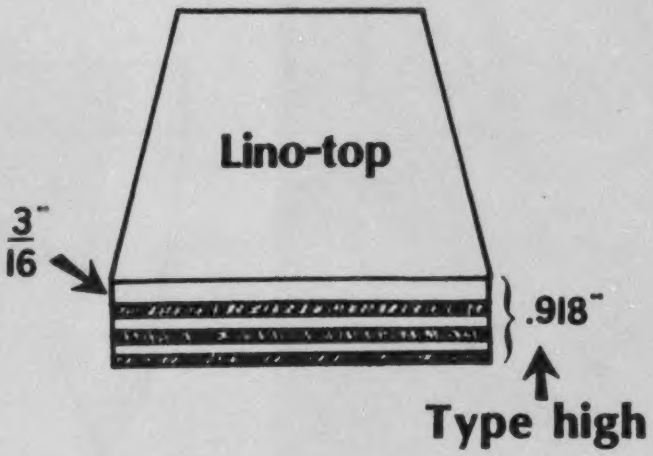


Paper laid on inked surface

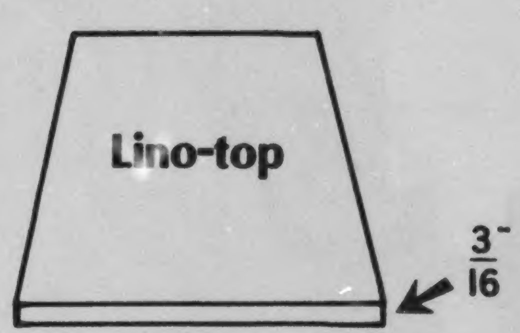


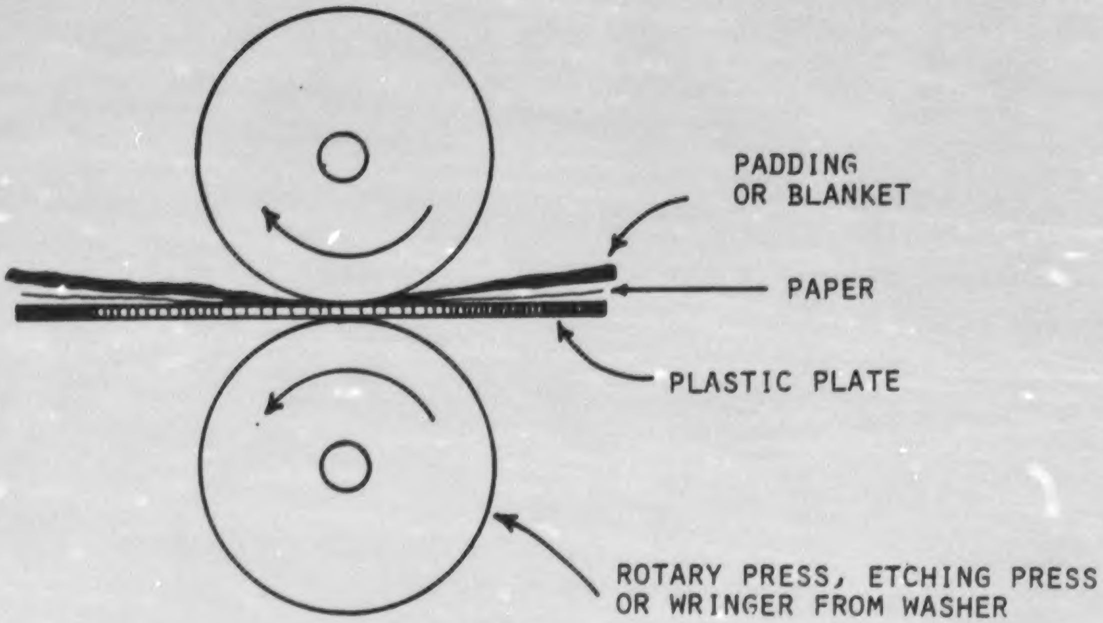
Impression from block

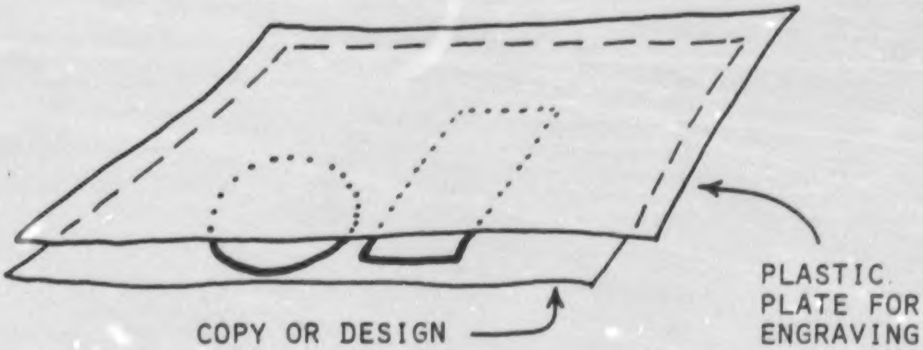
MOUNTED FOR POWER PRESS

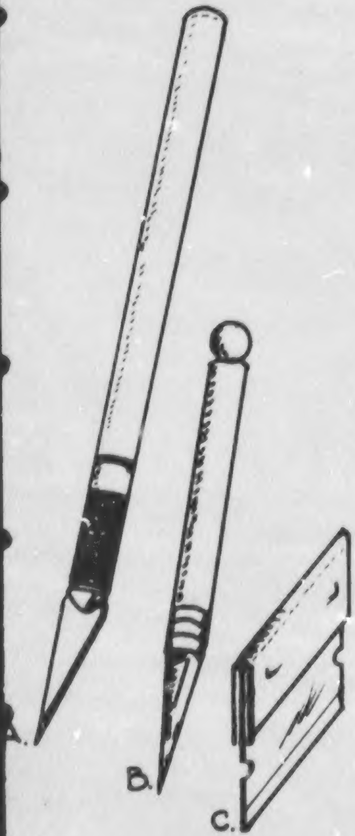

Lino-top
3"/16
.918"
Type high

UNMOUNTED


Lino-top
3"/16


PADDING
OR BLANKET
PAPER
PLASTIC PLATE
ROTARY PRESS, ETCHING PRESS
OR WRINGER FROM WASHER


PLASTIC
PLATE FOR
ENGRAVING
COPY OR DESIGN



A. X-ACTO KNIFE

B. BURIN

C. RAZOR BLADE

Gravure Printing

A. Gravure (also called intaglio, pronounced "in-tal-yo") is the opposite of relief printing. The design is engraved or etched below the surface of the plate.

B. Gravure plates may be either metal or plastic.

1. Commercial printers and artists generally use copper plates.

2. Plastic plates are recommended for a limited number of prints.

C. Gravure plates may be either engraved or etched.

1. Artists often use the engraving method. That is, they cut a design into the plate with special engraving tools.

2. Printers usually use the etching method. See below. If the plates attached to cylinders for printing, the process is called rotogravure.

D. Gravure cylinder etching.

1. Coat cylinder with a thin layer of copper, and grind and polish it smooth.

2. Expose the copy (design, text, or both) on sensitized carbon tissue through a gravure screen.

a. Carbon tissue is a gelatin layer on a paper base.

b. The gelatin becomes sensitive to light when chemically treated and receives the image during exposure.

3. The exposed carbon tissue is then placed in direct contact with the copper-plated cylinder.

a. Hot water develops the tissue and melts away the unhardened (unexposed) gelatin areas.

b. The areas which remain act as an acid-resist.

4. The paper backing is removed, and the gelating is allowed to dry.

5. The cylinder is placed in an etching tray where it rotates through the etching solution (acid).

a. The solution dissolves the areas of copper not covered by the gelatin acid-resist.

b. The depth of the image is determined by the length of time the cylinder is etched.

6. The cylinder is then washed with water, and all traces of the gelatin are removed.

Teacher Demonstration #1

BASIC LINOLEUM BLOCK PRINTING PROCEDURES

I. Objective

Demonstrate basic procedures for transferring design, cutting linoleum block and printing a black and white or one color print.

II. Materials

Linoleum block

Knife

Gouges

Steel square

Tracing/carbon paper

Pencil

Paper to print on

Block printing ink

Brayer/hand press

Glass sheet

Mineral spirits

Burnisher

Spoon

III. Procedures

1. Tape a piece of transfer/carbon paper face down onto the linoleum block.

2. Tape the design face down on the carbon paper.

3. Trace all lines of drawing with a pencil.

   A. The drawing will be in reverse.

   B. After cutting and printing the block the print will appear as in the original design.

4. After tracing remove papers from block and black in all parts of the design not to be cut away.

5. Cut away all white areas leaving raised areas to print block.

6. Ink the brayer on the ink slab.

7. Roll a thin coating of ink over the raised surface of the block.

8. Place paper down onto the inked surface of the block.

9. Hold carefully with one hand and burnish with a burnisher or the bowl of a spoon.

10. Pull print away and repeat.

11. Clean block by wiping with rag soaked with mineral spirits.

Student Activity #1

BASIC LINOELUM BLOCK PRINTING PROCEDURES

I. Objective

You will take a prepared design and a linoleum block and basic printing equipment and complete the following tasks: Transfer a design, cut and print a black and white or one color print.

II. Materials

Linoleum block

Knife

Gouges

Steel square

Tracing/carbon paper

Pencil

Paper to print on

Block printing ink

Brayer/hand press

Glass sheet

Minerals spirits

Burnisher

Spoon

III. Procedures

1. Tape a piece of transfer/carbon paper face down onto the linoleum block.

2. Tape the design face down on the carbon paper.

3. Trace all lines of drawing with a pencil.

    A. The drawing will be in reverse

    B. After cutting and printing the block the print will appear as in the original design.

4. After tracing remove papers from block and black in all parts of the design not to be cut away.

5. Cut away all white areas leaving raised areas to print black.

6. Ink the brayer on the ink slab.

7. Roll a thin coating of ink over the raised surface of the block.

8. Place paper down onto the inked surface of the block.

9. Hold carefully with one hand and burnish with a burnisher or the bowl of a spoon.

10. Pull print away and repeat.

11. Clean block by wiping with rag soaked with mineral spirits.

Student Activity #2

ACETATE FILM ETCHING

Objective: You will take the materials provided and complete the following tasks: Etch an acetate film plate and print it.

Materials:
1. Acetate film
2. pencil/paper
3. a scratch tool (compass, etc.)

Procedures:

1. Draw the master sketch in pencil on paper.

2. Tape a sheet of acetate over the sketch and scratch the lines on it with a sharp instrument.

3. Squeeze block printing ink onto a tile, wood board, or cardboard and roll it down evenly. Then press down a dauber made of cheesecloth or gauze to pick up the color. This is now daubed onto the scratched plate and excess wiped away with a clean rag.

4. Put the acetate plate on a cushion of newsprint. Place a sheet of printing paper on top of this. Weigh it with a book and stand on it to print, or run it through a press.

Student Activity #3

Objective: You will take the materials, as indicated and complete the following tasks:

Materials:

1/4" thick Masonite linoleum plastic or cardboard

black wrinkle finish spray paint (industrial finish)

print makers, hot plate, or heat lamp

white chalk for tracing

white lacquer (brushing type) acrylics or enamels

lacquer thinner

soft brush

stiff etching ink or black ink

cotton rags

thick etching paper

etching press or washer wringer type

blotter paper

Procedures:

1. Cut Masonite or plate material to size and bevel edges.

2. Spray with black wrinkle finish paint. Spray second coat two minutes after first coat is dry.

3. Heat plate evenly on hot plate or with heat lamp. Do not overheat and bubble the paint.

4. Let plate dry thoroughly (overnight if possible), until mushiness goes away.

5. Chalk up the back of a tracing of design and trace white line onto black wrinkle finish.

6. Build up white paint in varying thicknesses as you develop the design on the plate.

7. Heat the plate and wet it or cover it completely with ink.

8. Wipe ink away with cloth

9. Dampen paper and place between blotters.

10. Heat plate slightly to soften ink. Place dampened paper on plate.

11. Run through press under pressure.

INSTRUCTIONAL AIDS

Book: See Appendix A for source

STUDENT ACTIVITIES

Demonstrate drypoint etching to the students, as this is a very practical means of simulating the production of a gravure press.

A. Intaglio print made by hand

B. Materials

  1. Sharp, pointed instrument
  2. Transparent celluloid or plastic
  3. Suitable design

C. Steps

  1. Tape celluloid over design and scratch in lines.
  2. Condition paper
     a. Soak antique book paper in water
     b. Place paper between blotters and weigh down
     c. Leave one hour--should be damp but not wet
  3. Prepare ink
     a. Soft-bodied ink
     b. Work in plate oil or ink reducer with knife
     c. Reduces tack
  4. Ink plate
     a. Lint-free cloth
     b. Dab ink into all etched lines
     c. Remove surplus with straight strokes
  5. Make print
     a. Use etching press with considerable pressure
     b. Compare with original

After the demonstration, have each student make a drypoint etching and reproduce three or four copies.

Activity Sheet #4

Intaglio Printing

Definitions: Intaglio Printing: The design is engraved or etched below the surface.

Dry - Point: Is a term used to describe a method of making an intaglio plate by hand using a sharp instrument.

Procedure:

1. Use a transparent vinylite fairly thin (.015") in thickness for plate.

2. Choose or make design that will lend itself to line reproduction.

3. Then place design under transparent plate, making it visible on the surface of the plate to be engraved.

4. Use sharp instrument (such as nail held in dowell) to scratch or engrave design on the plate. The closer the lines together the darker the area reproduced. The deeper the line, the darker it will reproduce.

5. Rub reduced ink (mixture of printer's ink with oil) into the engraved lines of plate with index finger.

6. Wipe entire plate with paper towel to remove the ink from the non-printing areas.

7a. Prints made directly from plate to paper by pressure.
 b. By printing on rubber blanket, then transfer the print from blanket to paper.

8. Examine the printed design.

A. If non-printed area smudged the plate was not properly wiped.

B. If image is to light, and not clear, it is possible that the ink was too thin.

C. After examining the first print, it is not unusual to discover engraved areas that need to be touched up.

D. Use solvent to clean plate and the blanket before making the next print.

9. It ispossible to reproduce two or more colors from one inking of the plate. This requires careful inking and careful wiping of the plate.

SUGGESTED TEST

Block Printing

1. List the three methods of block printing.

    a.

    b.

    c.

2. List some of the early uses of block prints.

3. Printing may be divided into two divisions:

    a.

    b.

4. Define:

    Battleship linoleum______________________________

    V-Gouge_______________________________________

    U-Gouge_______________________________________

    Brayer____

ANSWER SHEET

Suggested Test

1. a. Wood cut

   b. Linoleum

   c. Wood engraving

2. greeting cards, book covers, calendars, playing cards, pages of books murals

3. a. prints as a work of art

   b. all kinds of commercial prints

4. Battleship linoleum - linoleum used for block printing

   V-Gouge - Tool used for cutting wood cut or lino design

   U-Gouge - Tool used for gouging wood cut or lino design

   Brayer - Hardroller used to transfer the ink from inking slab to block

SILK SCREENING

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the principles of silk screening; equipment involved; stencil preparation; and how the silk screening process relates to the overall graphic communications industry.

CONTENT OUTLINE:

1. Principles of silk screening.
2. Basic equipment required.
3. Stencil production
    a. Hand stencil
    b. Photo stencil
4. Uses for silk screening

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Attend classroom discussions covering the silk screening process.
4. Do classroom demonstrations as required.

STUDENT ACTIVITIES:

1. Participate in classroom discussions on silk screening.
2. Discuss the basic principles of silk screening, equipment required and stencil preparation.
3. Complete lab activities as required.

OUTLINE OF CONTENT

I. Silk Screen Printing - a stencil process in which ink is forced through a mesh of silk or other synthetic screen material onto the surface of the printing stock. The screen stencil may be prepared by hand or photographically.

Screen printing is an interesting activity enjoyed by first graders to adults. It can be used to design clothing, print greeting cards, package wrapping, or posters. The activity may range from printing a prepared screen to designing and cutting your own.

Screen printing is basically accomplished by forcing ink through a piece of fabric blocked out by a stencil design onto a piece of paper.

Type of stencils used are paper stencils, block out stencils, tusche stencils or hand cut film stencils.

The paper stencil is the least expensive and simplest to prepare. The design must be simple and is cut out of a piece of oil paper. This method works well for designs such as large letters or numbers on shirts.

The block out method is accomplished by painting the screening fabric, in the areas where the ink is not to pass through, with some material that is not soluble in the ink used. Elmers glue is often used in this method.

The tusche stencils are favored by artists desiring an original painting effect. First the tusche is applied to the screen in the form of the desired image. After it has dried a block out is painted on. Next the tusche is dissolved by a solvent which leaves the image area clean and ready to print.

The hand-cut film method of screen printing reproduces designs of sharp, clean cut lines and infinite precision detail as well as large solid areas. The stencil film is easily cut and peeled as well as adhere to and removed from the fabric.

II. Basic Equipment

A. Screen frame - a rectangular hoop that keeps the fabric (screen) stretched tight for printing.

B. Screen - Polyester, nylon, organdy, silk or tafetta fabric.

C. Squeegee - the tool which forces the ink through the screen mesh onto the printing surface.

D. Substrate - the product material in silk screen printing that is to have a design printed on it.

E. Ink - the pigment (or coloring medium) that is forced through the screen onto the substrate.

Printing Equipment

Screen frame, screen base, side kick and squeegee. The screen frame holds the screen fabric in a tightly stretched position. The screen base provides a flat surface for positioning the stock for printing. The side kick is attached on either side of the screen frame holding it open when stock is positioned or removed during printing. The squeegee is used to force the ink through the open areas. The shape of the squeegee blade varies with the type of printing that is being done. The two most common types are the square edge blade which is used for flat surface normal printing and the round edge used for printing on textiles because it can force greater amounts of ink through the screen.

Special screen fabric may be purchased at most art supply or hobby shops but because of the expense, fabric shops are usually favored. Organdy, available at most fabric shops, is not a high quality printing screen, but is adequate in many cases.

III. Stencil Methods

A. Hand - any method where the image is put on the stencil by hand. It involves covering the surface to be printed with an impervious material like paper or cardboard. Openings are cut into the material, revealing underlying surface. Ink is passed across the stencil which acts to block out all but the open areas. When the stencil is removed only the shapes of the open areas are printed on the substrate. The two primary hand stencil methods are using paper and lacquer film.

B. Photo Stencil - any method whereby the image is put upon the screen using a photographic process. It involves breaking up the image photographically into a dot pattern similar to a halftone photograph. The printing screen is coated with a sensitizing solution and the dot pattern is photographically transferred onto the screen. On the part of the screen not to be printed the sensitizing solution is chemically hardened while the solution on the other parts of the screen is washed away leaving open areas on the screen. Ink can then be forced through the open areas on the screen onto the substrate.

1. Direct
2. Indirect

Types of Film

Hand-cut film is a thin layer of gelatin material with a plastic, wax paper, or mylar backing. There are two types of hand-cut film for screen process printing: (1) lacquer film and (2) aqua film. As the name implies, lacquer film is soluble in lacquer thinner and, therefore, must be used with a water soluble ink. Aqua film requires the use of a lacquer based ink because the film is water soluble.

Stencil Preparation

The original design must be prepared to actual size on paper the same size as that to be used for production. If the original design contains two or more colors each color area should be clearly marked by labeling each area or using colored pencils. A separate stencil must be cut for each color.

Cut the stencil film to a size that is about 2" larger on all sides than the original design. Place the film on top of the design with the gelatin side up. The gelatin side is usually the shiny side, and it is always the side which is easily cut and peeled away. Tape the film to the original copy, with the design positioned approximately in the center of the film. The design is visible through the stencil film.

When cutting the stencil film, work on a hard, smooth surface such as the glass surface of a light table. Use a sharp-pointed stencil knife. Light pressure on the stencil knife is required since you only need to cut through the gelatin coating. Intersecting lines should be slightly overcut, thus assuring sharp, even corners. The overcuts will close up when the stencil is adhered to the screen fabric. Too much pressure will emboss the backing and make it difficult to adhere the stencil to the silk. Use one piece of stencil film to cut only those areas that will print in the same color.

After the design area has been completely cut, lift the gelatin from the backing with the point of the stencil knife. Peel the gelatin from the backing very slowly and carefully, checking to be sure that no part of the design area has been overlooked during the cutting. Only remove the gelatin from the printing areas of the film. When th gelatin has been peeled away, remove the tape and original design from the back of the stencil film.

To position the registration guides, place the original design in the approximate center of the screen base. When the registration guides have been secured in position, place the prepared stencil in register on top of the original design and the stencil do not move away from the registration guides.

Direct contact between the screen and the stencil is necessary for good adhesion. It may be necessary to build up the stencil by placing several layers of newspaper (smaller than the screen frame) under the base cover.

Adhering the Stencil

Adhering the stencil bonds the screen fabric to the stencil. When lacquer film is used, lacquer thinner is the adhering liquid. Aqua film is adhered with water.

Moisten a cotton pad with a small amount of the proper adhering liquid. Too much adhering liquid will completely dissolve the gelatin. Press the cotton pad to the stencil. Do not rub, as this will burn the stencil.

The adhering liquid softens the gelatin, and the downward pressure forces the silk onto the softened gelatin. The stencil will darken in color when properly adhered to the screen. Light spots indicate poor adhesion.

Allow the adhered stencil to dry. A fan may be use to accelerate the drying time which is normally between 15 and 20 minutes.

After the drying period, remove the stencil backing. Pick up one corner and peel the entire backing from the stencil. This should be done slowly and carefully, checking to be sure the gelatin is not disturbed.

Block-Out--Paper Mask Method

The paper mask is prepared by cutting a piece of kraft paper that is slightly smaller than the inside dimension of the screen frame. Place the paper mask on top of the adhered stencil, and outline those areas that must be removed to allow the printing of the design. The cutouts should be about 2" away from the design on all edges.

Using gummed tape, secure the paper mask in position. The final masking should not interfere with the passage of the squeegee over the stencil. If the squeegee does not make direct contact with the silk the prints may be fuzzy.

IV. Areas of Specialization

- A. Commercial sign printing
- B. Poster printing
- C. Wall paper
- D. Table cloths
- E. T-shirts

Information Sheet #1

Terms and Definitions

1. Base - A flat board or table top to which the screen frame is hinged. (Bed)

2. Ink - The pigment (or coloring medium) that is forced through the screen onto the substrate.

3. Intaglio - The design is scratched, engraved, or etched into the plate. These depressions are filled with ink. Etching and drypoints are examples. Gravure printing is the industrial equivalent.

4. Planographic (or surface) - Printing is done from a smooth surface treated chemically or mechanically so that some areas will print and other areas will not. Offset lithography is the only common example.

5. Pushpin hinge - A two part hinge held in an interlocking position by a fitted pin or rod. It is used to attach the screen to the print bed.

6. Register - The exact positioning of the design image on the printing surface, a matter of special importance in multicolor work.

7. Registration guides - Small tabs of cardboard, metal or other material fastened to the base against which the stock to be printed is registered in a predetermined position.

8. Relief printing - That in which the design stands above the general level of the plates surface. Rubber stamps and fingerprints, woodcuts, linoleum cut, letter press.

9. Run - A shop term referring to the actual printing procedure or the extent of an edition.

10. Screen frame - A rectangular hoop that keeps fabric stretched tight for printing.

11. Silk screen printing - A stencil process in which coloring matter is forced onto the material to be printed through the mesh of the silk or organdy screen so prepared as to have pervious printing areas and impervious non-printing area.

12. Squeegee - Used to force the screen printing ink through the open mesh.

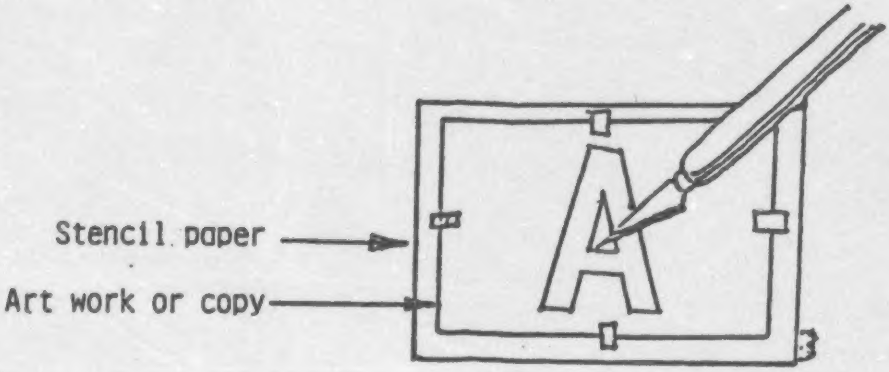
13. Stencil printing - Is accomplished by cutting designs out of stencil paper or by making some portions of thin fabric impervious to liquids. Ink goes through the open portions but not through those that are impervious. Silk-screen printing is the best known type.

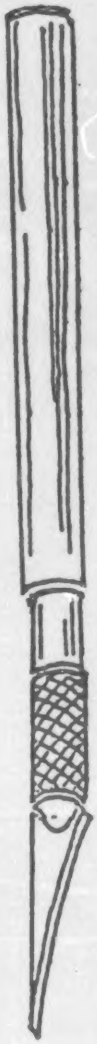
14. Stock - A broad connotation referring to paper, cardboard, glass, metal or whatever material is to be printed.

15. Substrate - The product material in silk screen printing that is to have a design printed on it.

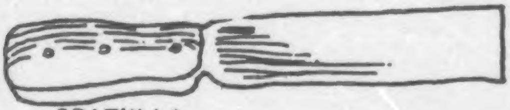
BASIC PRINTING EQUIPMENT

PAPER STENCIL

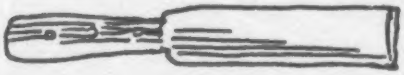

Stencil paper
Art work or copy



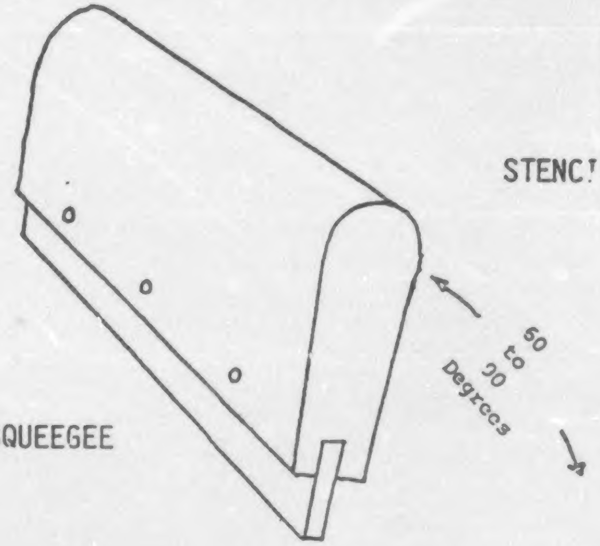
STENCIL KNIFE



SPATULLA

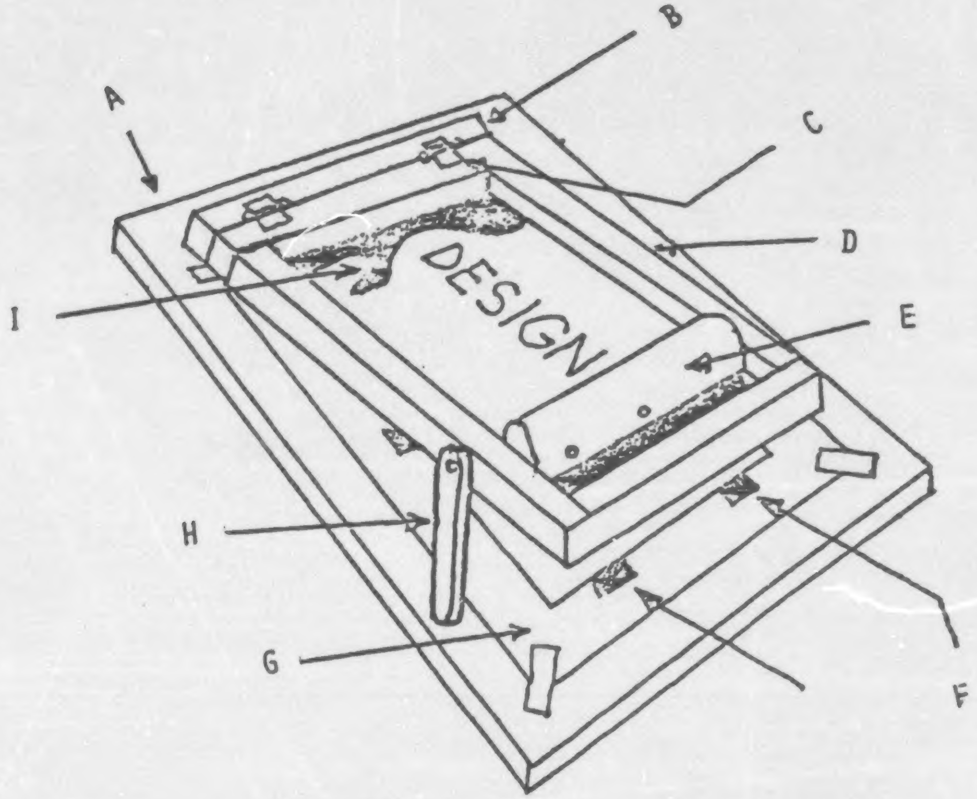


PUTTY KNIFE


60 to 90 Degrees

SQUEEGEE

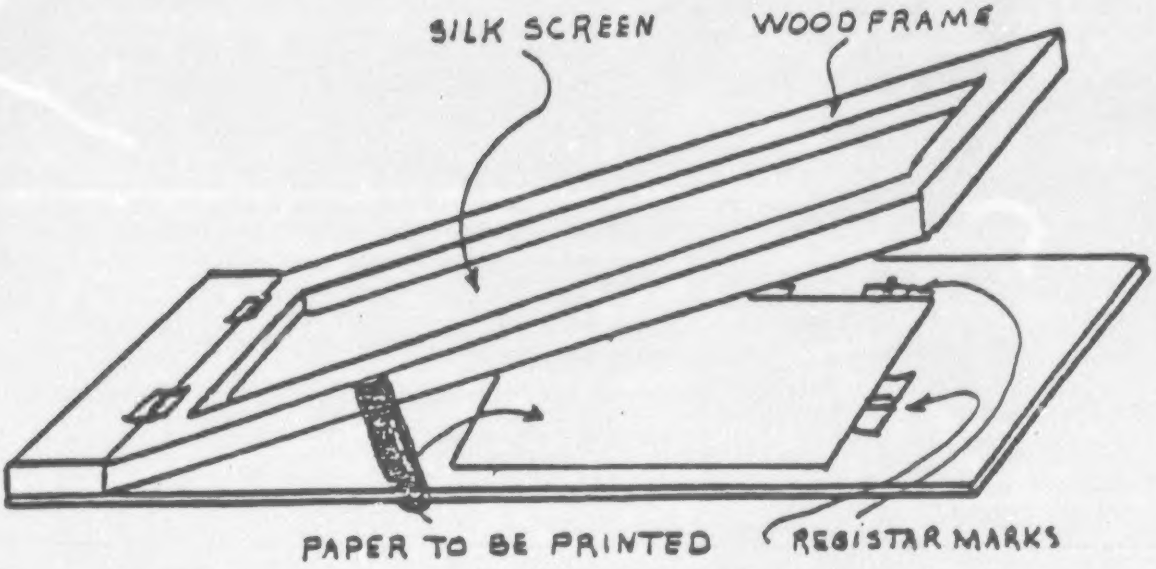
BASIC PRINTING EQUIPMENT

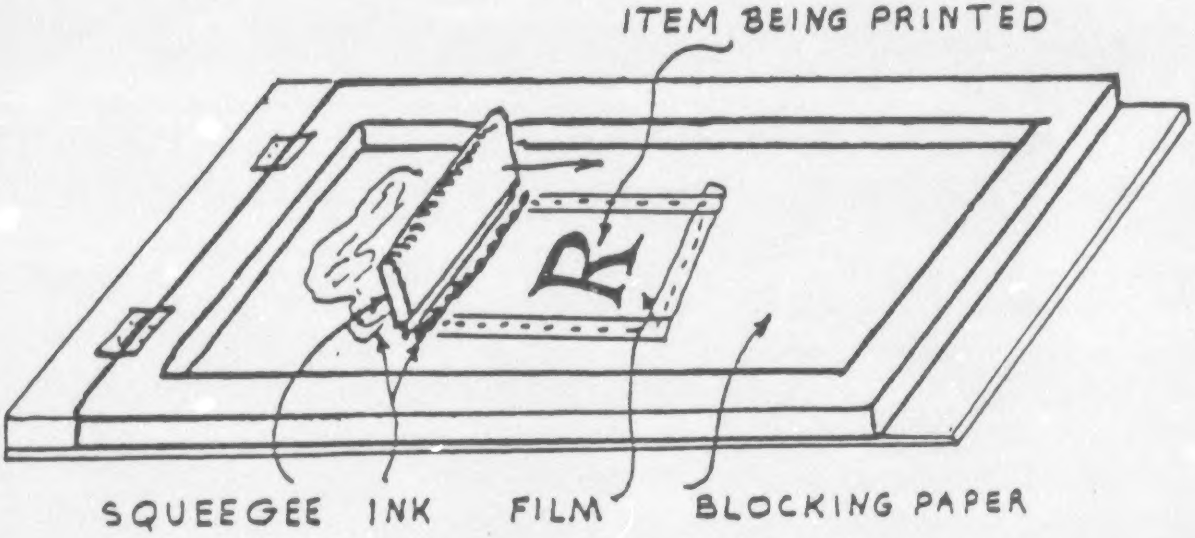


A - BASE- may be table top or any flat board
B - Hinge Bar
C - Loose Pin Hinges
D - Screen Frame
E - Squeegee
F - Guides - against which stock is placed when printing
G - Proof Sheet- attached to base with tape
H - Kick-leg or Prop-bar
I - Ink

INFORMATION SHEET ON SCREEN PRINTING

A TYPICAL SCREEN


SILK SCREEN
WOODFRAME
PAPER TO BE PRINTED
REGISTAR MARKS


ITEM BEING PRINTED
R
SQUEEGEE
INK
FILM
BLOCKING PAPER

FIVE BASIC METHODS ARE USED TO PREPARE SCREEN PRINTING IMAGE CARRIERS:

1. Paper stencil method.
2. Hand cut film method.
3. Wash out method (Tusche & glue).
4. Direct emulsion photographic method.
5. Indirect photographic method.

II. Film stencil process - the process plate is a transparent backing paper to which a film is attached.

A. In this process, preliminary sketches of a design can be made on any paper. Because a sketch is only used for tracing purposes in cutting the film plate, it is desirable that the sketch line should be made dark enough to see through the film plate.

B. The design should be made separately for separate colors. Only one color at a time can be printed.

C. Place the process plate on a drawing (design).

D. Cut out and peel off film section from backing paper where the ink will go through.

E. Apply the plate to the screen with a special solvent.

F. Register the position of the paper.

III. Photo screen (photo emulsion - see Appendix A for source)

A. Prepare design. A design should be made on tracing paper or transparent surface. The sketch must be dark enough so that it stops light from going through. There are many media that can be used to produce designs, such as black crayon on tracing paper, India ink on tracing paper, and photo negatives or positives.

B. Prepare photo sensitive emulsion. Combine 1/4 teaspoon ammonium bichromate with one ounce of water; then add seven ounces of photo emulsion ("screen star"). This process should be done in a semi-dark place. For storage of the solution, avoid all light. The solution will keep about two weeks.

C. Apply emulsion to screen. In a dimly lit room, hold the screen at a slant and pour some of the prepared emulsion onto the screen. Then, using a straightedge, spread the emulsion evenly across the screen. Some of the solution will run through to the back of the screen, so it is necessary to turn the screen over and even out the emulsion on the backside too. This process may have to be repeated once or twice. Excess emulsion which runs to the bottom of the screen can be scooped onto the straightedge and placed into the jar of emulsion for refuge.

D. Dry the screen after the emulsion is applied. Because of the emulsion's extreme sensitivity to light, the drying of the screen, after the emulsion is applied, must be done as quickly as possible and in a dimly lit or totally dark place. To speed the drying process, it is usually a good idea to place the screen in front of an electric fan; however, one must be careful that the screen and fan are in a fairly dust-free area so that particles of dust are not blown onto the screen, causing unwanted pinholes when printing.

E. Proper placement of design on exposure table.

1. Press tracing paper until flat if it is wrinkled. (Wrinkled tracing paper causes straight lines to be exposed as curved lines and also causes improper exposure in areas where the paper is not flat against the top of the light box.)

2. Clean the top of the light box, if dirty, for an opaque substance will block the light out before it reaches the design.

3. Place the design right side up on top of the light box.

4. Place the screen on top of the design.

F. Expose sensitized screen. Exposure time will depend on the light source.

G. Wash out (using a spray hose).

H. Block out undesirable holes or sections.

I. Register the position of the paper.

Demonstration #1

PAPER STENCIL METHOD

Objective:

To show the process of designing, properly preparing and printing a paper stencil.

Materials:

Carpet tacks or staples, if staple gun is available

Clean, soft, lintless cloths

Markers or guides for registering printing

Masking tape or gummed paper tape

Mineral spirits, kerosene, or turpentine

Newspaper, butcher paper

Screen printing frame

Screen fabric

Screen printing ink

Squeegee

Stencil knife

Stock or material upon which the print

Transparent tracing paper

Procedures:

1. Cut a brown butcher paper stencil 1/2" or so larger than the inside dimension of the screen.

2. Place tracing of original art or design in place. Trace cut outlines of the art using a well sharpened knife.

3. Place stencil sheet under the screen and run a band of ink the length of the image and along the hinge side of the screen.

4. With a firm and even pressure, squeegee it from the center outward to both sides.

5. Pull the squeegee across the screen firmly. The angle between the squeegee and the screen should be between 60 to 90 degrees.

6. Replace the squeegee along the hinge side of the screen.

7. Remove the proof sheet or newspaper and insert the material to be printed.

8. After printing is completed, remove excess ink with cardboard or spatula for reuse.

9. Place newspaper between screen and base, pour small amount of solvent on screen, work into screen with soft cloth. Raise screen occasionally to work from both sides. Be sure all ink has been removed from the image area and frame.

Demonstration #2

PHOTO STENCIL METHOD

Objective:

To show the process of preparing and printing a photo stencil.

Materials:

Light box

Screen

Emulsion

Cleaning solvent

Rags

Glue

India ink and tracing paper

Printing ink

Squeegee

Spatula

Masking tape

Newspaper

Pen or brush for preparing design

Procedure:

1. Prepare the design - design should be made on tracing paper or transparent surface. The sketch must be dark enough so that it blocks out any light source, for example, black crayon, on tracing paper, or India ink on tracing paper, a photo negative or positive.

2. Prepare photo sensitive emulsion - follow package instructions for mixing of sensitizer and emulsion. The proportion is usually 1 part of sensitizer to 4 parts emulsion. This process is to be done in a semi-dark area.

3. Apply emulsion to screen - in a dimly lit room hold screen at a slant and apply emulsion onto the screen. Spread emulsion across the screen using a straight-edged tool. Turn screen over and even out emulsion on backside. Repeat process once or twice. Remove excess emulsion and replace in jar for reuse.

4. Dry screen - after emulsion is applied let screen dry, as

quickly as possible in dimly lit room. A fan should be used to speed drying process, being careful that the screen and fan are in a fairly dust-free area.

5. Placement of design on exposing table -

   a. Clean top of light box if dirty

   b. Place design right side up on top of exposing unit (light box)

   c. Place screen on top of design

6. Expose sensitized screen - expose screen - time will differ according to light source.

7. Wash out - using a spray hose, wash screen until design appears in screen.

8. Block out holes, etc., with glue or excess emulsion.

9. Register position of paper.

10. Print.

Student Activity #1

PAPER STENCIL METHOD

Objective:

You will take the materials given and correctly complete the following tasks: cut paper stencil to size, fasten art to stencil, cut stencil, adhere stencil to screen, print screen.

Materials:

Carpet tacks or staples, if staple gun is available

Clean, soft, lintless cloths

Markers or guides for registering printing

Masking tape or gummed paper tape

Mineral spirits, kerosene, or turpentine

Newspaper, butcher paper

Screen printing frame

Screen fabric

Screen printing ink

Squeegee

Stencil knife

Stock or material upon which to print

Transparent tracing paper

Procedures:

1. Cut a brown butcher paper stencil 1/2" or so larger than the inside dimension of the screen.

2. Place tracing of original art or design in place. Trace cut outlines of the art using a well sharpened knife.

3. Place stencil sheet under the screen and run a band of ink the length of the iage and along the hinge side of the screen.

4. With a firm and even pressure, squeegee it from the center outward to both sides.

5. Pull the squeegee across the screen firmly. The angle between the squeegee and the screen should be between 60 to 90 degrees.

6. Replace the squeegee along the hinge side of the screen.

7. Remove the proof sheet or newspaper and insert the material to be printed.

8. After printing is completed, remove excess ink with cardboard or spatula for reuse.

9. Place newspaper between screen and base, pour small amount of solvent on screen, work into screen with soft cloth. Raise screen occasionally to work from both sides. Be sure all ink has been removed from the image area and frame.

Student Activity #2

PHOTO STENCIL METHOD

Objective

You will take the materials given and correctly complete the following tasks: design, properly prepare, and print a photo-stencil screen.

Materials:

Light box

Screen

Emulsion

Cleaning Solvent

Rags

Glue

India ink and tracing paper

Printing ink

Printing stock

Squeegee

Spatula

Masking tape

Newspaper

Pen or brush for preparing design

Procedure:

1. Prepare the design - design should be made on tracing paper or transparent surface. The sketch must be dark enough so that it blocks out any light source; for example, black crayon on tracing paper, or India ink on tracing paper, a photo negative or positive.

2. Prepare photo sensitive emulsion - follow package instructions for mixing of sensitizer and emulsion. The proportion is usually 1 part of sensitizer to 4 parts emulsion. This process is to be done in a semi-dark area.

3. Apply emulsion to screen - in a dimly lit room hold screen at a slant and apply emulsion onto the screen. Spread emulsion across

the screen using a straightedge tool. Turn screen over and even out emulsion on backside. Repeat process once or twice. Remove excess emulsion and replace in jar for reuse.

4. Dry screen - After emulsion is applied let screen dry, as quickly as possible in dimly lit room. A fan should be used to speed drying process, being careful that the screen and fan are in a fairly dust-free area.

5. Placement of design on exposing table -

a. Clean top of light box if dirty

b. Place design right side up on top of exposing unit (light box)

c. Place screen on top of design

6. Expose sensitized screen - expose screen - time will differ according to light source.

7. Wash out - using a spray hose, wash screen until design appears in screen.

8. Block out holes, etc., with glue or excess emulsion.

9. Register position of paper.

10. Print.

AREAS OF SPECIALIZATION

The production of commerical signs and posters constitutes the backbone of the screen printing industry in terms of total number of people employed, output measured by annual dollar volume of business, and number of individual businesses.

Screen printing on container ware has evolved into a distinct field of operation quite separate and apart from routine screen printing. The decorative motifs on drinking glasses have been printed by the screen process. It is the most economical and effective way to print colors on glass.

It is difficult to categorize the great diversity of fabrics and end products in the broad area of the textile decorating field that lend themselves to screen printing. Dress goods, toweling, drapery and upholstery material, tablecloths and napkins, cloths used for shirting, lounge and sleepwear and t-shirts represent a partial listing of products that can be screen printed.

Screen printing, with particular preference to wall paper, has a number of advantages. It's possible to print a light color over a dark ground when the design calls for it. It's less expensive for short run editions. Stencils cost less to prepare than the printing plates used in gravure an other methods. Colors can be as bright as you want them to be.

TECHNIQUES OF SCREEN IMAGE TRANSFER

I. Points to be emphasized

A. Each color must be printed from a separate screen.

B. Ink should be chosen according to the characteristics of the surface on which the designs will be printed. For example, textile ink should be prepared for a cloth surface. Information about these supplies is available at any paint store.

C. Silk is suitable material for the film stencil process, but for the photo screen process, nylon fabric must be used as the screen. This is because the bleach which must be used in removing the solution after printing will damage a silk screen.

II. Printing procedures

A. Before printing, check the screen once again for unwanted holes. Holes may be blocked out with Lepage's glue or masking tape.

B. Insert paper accurately using registering mark.

C. Pour ink from can onto the screen.

D. Apply pressure evenly with the squeegee as it is pulled completely across the screen.

III. Drying

A. Before the actual printing starts, a drying method should be planned such as: hanging the prints from a line with slips, placing the prints on a drying rack, or by heat (a method used commercially).

B. If the prints are hung or placed in the room, it usually takes them forty minutes to dry.

IV. Cleaning the screen

A. Film screen process - After the printing has been completed, the stencil can be removed from the screen in the following manner: Place newspapers under the screen and saturate the screen with lacquer thinner for a few minutes. By this time the stencil should be stuck to the paper and should come away with it.

B. Photo screen process - Clean the screen with turpentine to remove the oil based ink. Next, wash the screen completely with liquid soap. Then to remove the chemical solution, soak the screen with cold water, and fan dry. (When using bleach it is advisable to use rubber gloves and to avoid inhaling fumes.)

V. Silk-screen products produced commercially

- A. Signs and posters
- B. Greeting cards
- C. Decorative gift wrap paper
- D. Book covers
- E. Art prints
- F. Lamp shades
- G. Charts and presentation books
- H. Rugs and carpet
- I. Bottles and other containers
- J. Tumblers and other kitchen glassware
- K. Trays and placemats
- L. Flocked products
- M. Simulated furs
- N. Wallpaper
- O. Textiles
- P. Decals
- Q. Printed circuits

Student Activity #1

SILK-SCREENING PRINTING

PRINTING ON A T-SHIRT

STUDENT LEARNING OBJECTIVE:

Learn the principles of silk-screen communications, including assembling the image carrier and transferring the image.

Each student will design an expression or concept to communicate an idea to the receiver, via a t-shirt. The design could be the school symbol or name, or the student's own idea. It will be a requirement that the student communicate some idea or concept on the t-shirt.

ADMINISTRATIVE PROCEDURE:

Have each student prepare a design, cut his screen, and print his t-shirts. Then have each student evaluate his own project.

GENERAL TEACHER OUTLINE:

Refer to Handout Sheet for Printing on a T-Shirt, the student activity for this lesson.

Also refer to photo screen method (III in the Lesson Outline for this lesson) for best results.

MATERIALS AND EQUIPMENT:

Light box

Nylon covered screen frame

Ammonium bichromate

Photo emulsion (Screen Star #71)

Turpentine for clean up

Rags

Bleach to remove stencil from screen

Liquid soap

Engraver's opaque or India ink and tracing paper

Appropriate printing ink and thinner for t-shirt

Squeegee for printing

Spatula

Masking tape and paper

Newspaper

Supply of t-shirts

Drying rack or clothesline

Ink pens or brush for preparing design

Cardboard to stretch the shirt

Rounded plastic straightedge to scrape emulsion across silk

HANDOUT SHEET FOR SILK-SCREEN PRINTING
ON A T-SHIRT

Note to the Students: Do each of the following items in the sequential order given and check to the left of the number when complete.

Preparing the screen

____ 1. Prepare design. A design should be made on tracing paper or transparent surface. The sketch must be dark enough so that it stops light from going through. There are many media that can be used to produce designs, such as black crayon or India ink on tracing paper and photo negatives or positives.

____ 2. Prepare photo sensitive emulsion. If not already done, combine 1/4 teaspoon ammonium bichromate with one ounce of water; then add seven ounces of photo emulsion ("screen star"). This process should be done in a semi-dark place. For storage of the solution, avoid all light. The solution will keep about two weeks.

____ 3. Apply emulsion to screen. In a dimly lit room, hold the screen at a slant and pour some of the prepared emulsion onto the screen. Then, using a straightedge, spread the emulsion evenly across the screen. Some of the solution will run through to the back of the screen, so it is necessary to turn the screen over and even out the emulsion on the backside too. This process may have to be repeated once or twice. Excess emulsion which runs to the bottom of the screen can be scooped onto the straightedge and placed into the jar of emulsion for reuse.

____ 4. Dry the screen after the emulsion is applied. Because of the emulsion's extreme sensitivity to light, the drying of the screen, after the emulsion is applied, must be done as quickly as possible and in a dimly lit or totally dark place. To speed the drying process, it is usually a good idea to place the screen infront of an electric fan; however, one must be careful that the screen and fan are in a fairly dust-free area so that particles of dust ar not blown onto the screen, causing unwanted pinholes when printing.

____ 5. Proper placement of design on exposure table.

a. Press tracing paper until flat if it is wrinkled. (Wrinkled tracing paper causes straight lines to be exposed as curved lines and also causes improper exposure in areas where the paper is not flat against the top of the light box.)

b. Clean the top of the light box, if dirty, for an opaque substance will block the light out before it reaches the design.

c. Place the design right side up on top of the light box.

d. Place the screen on top of the design.

e. Block outside light from exposing the screen from the top by placing either black construction paper or a piece of black rubber on top of the screen.

f. Place weights in various places on top of the black paper or rubber to make sure that the design is pressed flat against the screen. (For a good cut, it is essential that adequate pressure be applied to the top of the screen.)

____ 6. Expose sensitized screen. Exposure time will depend on the light source.

____ 7. Wash out. (using a spray hose)

____ 8. Block out undesirable holes or sections.

____ 9. Register the position of the paper.

Transferring the Image

____10. Use a spatula to place a quantity of ink in the screen frame. Sufficient ink should be used so that it will roll in front of the squeegee, covering the design in one stroke.

____11. The squeegee is held at a slight angle so that only the sharper edge of the rubber blade contacts the silk. With a firm downward pressure, pull the squeegee across the open areas in the screen. To get basic results, use only one stroke to make one print. The squeegee should be wide enough to cover the area of the design. It is also important that the rubber blade of the squeegee be straight, and the edges sharp. When the blade becomes rounded, it can be sharpened by drawing it back and forth over sandpaper, holding the squeegee in a vertical position.

____12. Place the screen frame over the t-shirt and print. Under normal conditions, without artificial heat, about thirty minutes is required for the ink to dry. Prints should be laid out singly in the drying rack. Do not stack them until they are dry.

Cleaning the Printing Frame

____13. When the printing operation has been completed, clean the screen printing frame. Screens are most easily cleaned immediately after printing, before the ink dries in the meshes of the silk. Use a piece of scrap cardboard to scrape up the ink remaining in the frame. Use an ink knife to push the ink from the carboard back into the ink can. Do not scrape the ink knife on the edges of the can because it is necessary that the top edge of the can be kept clean so the cover will fit tightly to prevent the ink from drying out.

____14. After excess ink has been taken out of the screen frame, remove the masking tape and wrap in newspaper before depositing in the wastepaper container.

____15. Place several layers of newspaper under the screen printing frame. Saturate a wiping cloth with a solvent, then wash the silk and stencil on both sides. Screen properly cleaned after printing can be used for many stencils.

____16. To remove the stencil, place more newspapers under the screen and pour bleach on top of the screen and let soak for 3 to 4 minutes. Then rinse screen with cool water. Stubborn stencils can be cleaned with lacquer thinner. (If using lacquer thinner, beware of fumes.)

SUGGESTED TEST

1. Screen printing is a stenciling method originating in _______________.

2. List two advantages of silk screen printing.

   a.

   b.

3. Give one disadvantage of silk screen printing.

   a.

   b.

ANSWERS TO SUGGESTED TEST

1. Asia

2. a. Good for short runs

   b. Can be printed on almost any surface

3. Not good for long runs

300

CAREER OPPORTUNITIES

UNIT OBJECTIVE:

Upon completion of this unit, the students will possess a basic knowledge of the career opportunities which are available within the graphic communications industry and possess a rudimentary knowledge of the duties associated with these various career opportunities.

CONTENT OUTLINE:

1. Printing occupations
2. Machine maintenance
3. Skilled occupations
4. Training
5. Career positions

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to content outline.
3. Attend classroom discussions covering career opportunities.
4. Prepare handouts for students which list job titles and provide an overall job descriptions of the career opportunities in the printing industry.

STUDENT ACTIVITIES:

1. Participate in lecture discussions on career opportunities.
2. Develop a listing of possible job opportunities available within the local community's printing industry.

Information Sheet #7

CAREERS IN PRINTING INDUSTRY

Almost every town in the country has a print shop. Some of them are weekly newspapers which take on other printing jobs to keep the presses running. More than one-half of the people employed in printing are located in five states: New York, Illinois, California, Pennsylvania, and Ohio. Most of the printing plants are located near cities that have large populations. These are places such as New York City, Chicago, Los Angeles, Philadelphia, San Francisco-Oakland, Cincinnati, and Cleveland. Book and magazine printing are highly concentrated in these areas. There are some other large employment areas for printers.

PRINTING OPPORTUNITIES

Production of printer materials involves workers in a wide variety of jobs. Printing skilled workers numbered about 400,000 in 1970. They represent a large portion of the printing occupations. They usually specialize in one area of printing operations (for instance, typesetting, photography, platemaking, presswork, or binding). Their training, moreover, is confined largely to only one of the basic printing methods - letterpress, lithography, or gravure.

The largest group of skilled workers is the composing room workers. There were about 185,000 of them in 1970. This group includes hand compositors, type-setting machine operators, make-up people, tape-perforating machine operators.

Other large groups of skilled workers are printing press workers and their assistants, lithographic skilled workers, including camera operators, artists, strippers, platemakers, and lithographic pressworkers. Some of the other important printing skilled workers are bookbinders, photoengravers, electrotypers, and stereotypers.

MACHINE MAINTENANCE

A number of different trades are employed in the maintaining of machines that produce copy and actually do printing. For instance, maintenance machinists repair and adjust typesetting machines, printing presses, or bindery equipment. They are usually found working in large plants. In most of the smaller plants the owner may hire someone to do the work whenever it is needed.

SKILLED OCCUPATIONS

Most of the skilled occupations use men. Practically all these occupations are filled by men. However, many of the less skilled jobs, especially in the binderies are filled by women. This is changing as women are becoming more skilled and interested in these high paying jobs.

Printing equipment used today is becoming complex and mechanized. Because of this, the need is growing for technically trained people in all areas of printing. An increasing number of production technicians are being employed throughout the printing industry. These people are responsible for seeing that the standards established for printing each job are met. Many of these people acquire experience working in small shops and then move on to larger companies.

TRAINING

Apprenticeship is a common method of getting a start in the printing crafts. In some cases, it is the only means by which a person may be trained to become a journeyman (skilled worker) in a unionized shop. A formal program of apprenticeship is required for journeyman status in many larger establishments that are not unionized.

In 1970 there were about 13,800 apprentices registered as in training in the skilled printing crafts. A registered apprentice is an employee, who, under an agreement, receives instruction in a specific occupation for a specified period time. The apprentice is registered with a state apprenticeship or the U.S. Dept. of Labor's Bureau of Apprenticeship and Training.

Apprenticeships for the printing trades usually last from 4 to 6 years. The program covers all sides of the particular trade. It generally includes classroom or correspondence study courses. The materials studied are directly related to the job being done at the time. As new printing methods are developed and introduced, they generally are included in the duties of the traditional printing crafts and in the apprenticeship program.

COMMUNICATIONS

JOB STRUCTURE: PRINTING

JOB TITLE: Photoradio Operator
D.O.T. No.: 193.362.010

Major Job Function:

Operates electronic equipment to transmit and receive radio photographs and repairs equipment.

Job Duties:

1. Mounts photographs or printed matter on cylinder and secures with a gripper bar.

2. Turns dials to set frequency controls.

3. Starts equipment that scans material and converts light and dark areas into electrical impulses for transmission.

4. Communicates with receiving operator to give and receive instructions for transmission.

5. Positions negative on cylinder, sets controls, and listen for signals to receive transmission.

6. Develops negatives, prints photographs, and keeps log of transmissions.

7. Maintains and repairs electronic equipment, such as wire circuit, dials and gauges, using schematic diagram, handtools, and test instruments.

8. Reruns transmission when photograph is substandard.

JOB TITLE: Linotype Operator
D.O.T. No.: 650.582.010

Major Job Function:

Operates machine to cast complete lines of type from type metal and deposits them in galley in composed form for printing.

Job Duties:

1. Starts type-casting mechanism and adjusts marginal stops and gauge to regulate length and thickness of lines to be cast.

2. Reads copy and presses keys of keyboard to select matrices of letters from magazines which are assembled into words.

3. Moves lever to cast line and deposit it in galley when line is complete.

4. Transfers lines of type, with copy, to composing or bank table for making proof copy.

5. Sets new lines of type to correct errors as indicated on proofsheet.

JOB TITLE: Photocomposing Machine Operator
D.O.T. No.: 650.582.018

Major Job Function:

Sets up and operates photocomposing machine to transfer data from perforated or magnetic tape into print on film or photographic paper, using either of the following methods.

Job Duties:

(I) 1. Loads roll of film or paper in machine magazine.

2. Secures roll of perforated tape on machine reel and threads end of tape through machine feed rollers.

3. Selects type font according to size and face of type specified and positions it on photogrphic unit.

4. Turns dials to adjust line spacing and light intensity according to size and face of type.

5. Starts machine that automatically prints type onto film or paper according to coded signal on tape.

6. Removes finished copy from magazine for development.

(II) 1. Places reel of magnetic tape onto feed spindle of phototypesetting unit.

2. Depresses keys to enter command codes, such as size and style of type, width and length of column, and to activate computer to produce phototypesetting film, phototypesetting paper, or copy of tape.

3. Removes and stacks finished copies from photocopy printing unit.

4. Removes printing unit from machine, drains chemical solution, washes unit, and refills unit with specified developing solution.

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JOB TITLE: Engraving Press Operator
D.O.T. No.: 651.382.010

Major Job Function:

Makes ready and operates press to engrave decorative designs or lettering on announcements, greeting and business cards, letterheads, and related items, following operating procedures outlined on job order.

Job Duties:

1. Installs appropriate die and inking rollers on ram, using wrench.

2. Cuts out and fastens paper template to bed of press to maintain flatness of finished cards or sheets.

3. Inserts and adjusts roll of wiping paper that automatically cleans die between impressions.

4. Thins ink to desired consistency and fills ink fountain.

5. Starts press to obtain proof copy.

6. Examines proof and adjusts press and ink fountain to obtain uniform indentation and color registration.

7. Starts press and feeds cards or sheets to be engraved onto bed of press.

JOB TITLE: Offset-Press Operator
D.O.T. No.: 651.482.010

Major Job Functions:

Makes ready and operates offset printing press to print single and multicolor copy from lithographic plates, examining job order to determine press operating time, quantity to be printed, and stock specifications.

Job Duties:

1. Washes plate to remove protective gum coating.

2. Builds up back of plate with sheets of folio to raise plate to printing level.

3. Installs plate with backing on plate cylinder and locks in position, using handtools.

4. Applies folio to blanket cylinder to build up to diameter of plate cylinder.

5. Fills ink fountains.

6. Adjusts space between blanket and impression cylinder according to thickness of paper stock.

7. Adjusts controls to regulate moisture delivery to plate cylinder.

8. Operates press to secure proof copy.

9. Examines proof and adjusts press controls to obtain specific color registration.

10. Starts press and completes production run.

11. Removes and cleans plate and cylinders at end of run.

JOB TITLE: Embosser
D.O.T. No.: 659.382.010

Major Job Function

Sets up and operates machine to emboss gilt or blind (without goldleaf) lettering and design on book covers, following specifications.

Job Duties:

1. Glues embossing plate to copper backing plate and installs it in hot plate of machine.

2. Cuts piece of cardboard to approximate size of plate and places it on machine bed under plate.

3. Starts machine to lower ram and impress cardboard.

4. Cuts surface of cardboard around impression, leaving design or letters raised to increase machine pressure at contact points, using knife, compass, and square, and glues it to bed under plate, adjusting bed so impression and plate are in alignment.

5. Closes switch to heat plate.

6. Sets guides to hold cover in position, and adjusts table height to obtain correct depth of impression.

7. Places cover, with prelaid goldleaf in position, against guides on machine bed and starts machine that lowers ram and stamps goldleaf design or lettering on cover.

8. Removes and stacks embossed covers.

9. Stamps blind lettering or designs on covers in like manner.

JOB TITLE: Telephone Directory Distributor
D.O.T. No.: 906.683.018

Major Job Function:

Drives automobile or truck to transport telephone directories from central storage facilities to distribution area.

Job Duties:

1. Loads vehicle with assigned number of books and drives to distribution district, parking vehicle in convenient or centralized location.

2. Distributes books to Telephone Directory Deliverers for delivery to residences and business establishments indicated on address lists.

JOB TITLE: Photoengraving Etcher
D.O.T. No.: 971.381.014

Major Job Function:

Etches metal photographic plates to produce photoengraved printing plates, using Etching Machines, handtools, and chemicals.

Job Duties:

1. Mixes caustic or acid solutions according to type metal plate being etched.

2. Brushes protective solution on back and edges of metal plate to protect plate during etching process.

3. Brushes protective powder over photographic emulsion on plate to protect printing design.

4. Bakes plate to adhere powder to design, using gas heating plate.

5. Mounts plate in etching machine and starts machine that sprays acid or caustic solution against plate to etch areas not protected by resist solution or power.

6. Removes and measures plate to determine depth of etching, using depth gauge, and remounts plate in machine when etching has not attained specified depth.

7. Washes and scrubs etched plates to remove resist solutions and photographic emulsion, using brush and caustic.

8. Dries plates, using chamois cloth.

9. Matches colors with artwork of multicolor photographic plates to produce balanced color valves, applying knowledge of photographic printing process.

JOB TITLE: Photoengraver
D.O.T. No.: 971.381.022

Major Job Function:

Photographs copy, develops negatives, and prepares photosensitizine metal plates, such as copper, zinc, aluminum, and magnesium for use in printing, using photography and developing equipment and engravers' hand tools.

Job Duties:

1. Positions copy on copy board of darkroom camera and exposes film to copy.

2. Fastens scoured metal plate to whirling machine table or suspension hooks, pours photosensitizine solution on plate and starts machine which rotates plate to distribute and dry solution evenly over plate surface.

3. Exposes negative and plate to bright light in vacuum type printing frame to transfer image onto plate.

4. Rolls ink onto exposed plate and washes unexposed and unfixed emulsion from plate, using running water and cotton pad to expose bare metal.

5. Places developed plate in acid bath or etching machine to erode unprotected metal to specified depth.

6. Mounts etched plates on wood blocks, using hammer and nails or on metal base, using thermosetting adhesive to raise printing surface type to specified height.

7. Removes excess metal from non-printing areas of cut, using routing machine.

8. Cuts mortises in mounted plates, using power drill and jigsaw, for insertion of type or other cuts.

9. Modifies and repairs finished plates, using engraver's hand tools, etching brush, and acid.

JOB TITLE: Photoengraving Finisher
D.O.T. No.: 971.381.030

Major Job Function:

Blocks out, re-etches, or intensifies designs to refine or repair copper, zinc, aluminum, and magnesium photoengraved printing plates according to copy and specifications, using artist's brushes and hand engraving and burnishing tools.

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Job Duties:

1. Applies chalk to engraved surface and examines cut under magnifying glass to detect damaged halftone dots and evaluate quality of etching against copy.

2. Outlines images, cuts border,blocks out backgrounds, and raises halftone dots, using engraving tools.

3. Burnishes high halftone dots to correct defects in printing quality and contrast of cut, using burnishing tools.

4. Repairs breaks in type, using hand tools.

JOB TITLE: Photoengraving Proofer
D.O.T. No.: 971.381.038

Major Job Function:

Proves printing quality and register of photoengraved printing plates, using hand or power driven flatbed or cylinder press, and prepares data sheet on color matching or ink modification to improve printing quality and register according to copy or customer specifications.

Job Duties:

1. Clamps plates to press, applies ink to rollers, and positions guides, grippers, and fingers to guide paper through press.

2. Wraps packing sheets and tympan sheet to increase impression of low areas.

3. Cuts and pastes overlays under tympan sheet to increase impression of low areas.

4. Depresses pedal to open grippers, inserts blank sheet, and turns crank or starts motor to print set of proofs for progressive proof book for both black and white and color plates.

5. Prepares data on color matching and ink modification to guide pressman.

6. Examines proofs to determine printing quality of dots and lines, using magnifier, and marks corrections, such as re-etching and additional finishing.

JOB TITLE: Photoengraving Photographer
D.O.T. No.: 971.382.014

Major Job Function:

Sets up and operates camera to photograph drawings, sketches, or other material to produce negatives for transfer to printing plates, rollers, or printed circuit boards.

Job Duties:

1. Mounts copy on holder, aligning center line on copy with center line on holder.

2. Studies copy and order sheet to determine photographic technique required to transfer desired effect onto film, according to plate or roller dimensions, type of design, colors in design, and engraving requirements.

3. Computes camera settings required to reproduce sketch to specified scale according to dimensions of printing plates or rollers.

4. Focuses camera, compensating for difference in size and distortions in copy.

5. Measures opening in back of camera to verify settings, using steel tape.

6. Positions film on vacuum board, closes board against back of camera, and locks board in position.

7. Arranges arc lamps for even distribution of light and exposes film for specified length of time.

8. Removes exposed film from camera and develops film in series of developing, rinsing, and fixing baths, or using automatic film processing equipment.

9. Compares developed film with design to determine whether desired effect has been reproduced.

10. Hangs film on line to dry.

11. When producing negatives for half tone printing, inserts screen in front of film to reduce copy to dots for reproduction.

JOB TITLE: Scanner Operator
D.O.T. No.: 972.282.010

Major Job Function:

Operates electronic color scanner to produce color separated positive or negative films for use in producing printing plates.

Job Duties:

1. Examines copy to be reproduced for possible reproduction problems and plans work to include optimum corrections.

2. Evaluates density of colored and black areas, using knowledge of light and color and densitometer.

3. Sets scanner dials to indicate specific color density, size,

and type of film to be produced, and starts machine to automatically produce separate positive or negative films for each primary color and black contained in original copy.

4. Examines processed film to insure consistency of quality and places complete positive or negative and original copy in envelope for return to customer.

JOB TITLE: Lithographic Plate-Maker
D.O.T. No.: 972.381.010

Major Job Function:

Transfers positive or negative images to metal plates to produce offset photolithographic printing plates, according to oral or written instructions, using liquid formulas, photocomposing machine, plate whirler, layout table, and measuring instruments.

Job Duties:

1. Mixes chemicals, according to standard formulas and type metal used, to prepare platemaking solutions, such as counter-etch, photosensitive coatings, developers, gum solutions, lacquers, developing inks, and desensitizing etches, using graduates, beakers, and stirrers.

2. Washes grained metal plate with running water or acid solution to remove dirt and grease.

3. Pours counter etching solution over grained surface and spreads solution, using cotton pad, to prepare smoth surface on plate.

4. Clamps plate on whirler disk, starts machine, and pours sensitizing solution onto center of whirling plate to coat surface evenly.

5. Adjusts controls to regulate whirling speed, drying temperature, and humidity.

6. Positions plate under arc lamp of vacuum frame or photocomposing machine and exposes plate to positive or negative image under lamp to transfer image to plate.

7. Sets exposure time on vacuum frame or photocomposing machine according to density of negtive or positive, sensitivity of coating, temperature, humidity, and thickness of coating.

8. Washes exposed plate in water and applies lacquers, developing inks, desensitizing etches, gum solutions, and asphaltum to develop image on plate according to process specifications and metal use.

JOB TITLE: Lithographic Photographer
D.O.T. No.: 972.382.014

Major Job Function:

Sets up and operates camera to photograph illustrations and printed material and produce film or glass negatives or positives used in the preparation of lithographic printing plates.

Job Duties:

1. Mounts material to be photographed on copy board and focuses camera to enlarge or reduce size of object in photograph.

2. Selects and places screen over negative or positive to break up shadings in object for halftone printing.

3. Places color filters over film to produce four-color separation, halftone separation, and process prints for multicolor printing.

4. Focuses lens, adjusts lights, and exposes film to copy for specified period of time.

5. Immerses film in series of chemical baths to develop image on film or mounts film in machine that automatically develops film.

6. Hangs developed film on rack to dry.

JOB TITLE: Plate Grainer
D.O.T. No.: 972.682.010

Major Job Function:

Operates plate graining machine to roughen faces of flexible sheets of zinc or aluminum metal for use in offset-photolithographic printing.

Job Duties:

1. Operates power shear to cut sheets of aluminum or zinc to size, and clamps them to bed of graining machine tub.

2. Operates hydraulic lifting and ticting mechanism attached to machine to load and unload machine with specified amount of steel or wooden balls, water, and abrasive.

3. Washes sediment from plates with water hose at end of graining cycle and places on conveyor for further washing under water sets and drying under heating unit.

4. Examines each plate with magnifier at inspection table for uniformity, size, and structure of grain.

5. Stacks plates in shipping crate.

6. Rolls out and hammers used plates to remove gripper marks,

dents, and bent corners.

7. Lubricates machine and replaces worn bearings.

JOB TITLE: Compositor
D.O.T. No.: 973.381.010

Major Job Function:

Sets type by hand and machine, and assembles type and cuts in a galley, for printing articles, headings, and other printed matter, determining type size, style, and compositional pattern from work order.

Job Duties:

1. Measures copy with line gauge to determine length of line.

2. Sets composing stick to line length indicated on line gauge.

3. Selects type from type case and sets it in compositional sequence reading from copy.

4. Inserts spacers between words or units to balance and justify lines.

5. Transfers type from stick to galley when setup is complete.

6. Inserts leads, slugs, or lines of quads between lines to adjust length of setup, using proof press.

7. Examines proof for errors, corrects setup, and forwards it to imposing stone or bank.

8. Cleans type after use and distributes it to specified boxes in type case.

JOB TITLE: Printer
D.O.T. No.: 973.381.018

Major Job Function:

Sets type according to copy and operates cylinder or automatic platen press to print complete job order.

Job Duties:

1. Selects type from type case and inserts in printer's stick to reproduce material in copy.

2. Inserts spacers between words and leads between lines.

3. Slides type from stick into galley.

4. Removes assembled type from galley and places type on composing stone.

5. Places chase over type, inserts quoins and locks chase to hold type.

6. Lays form (type in locked chase) on bed of proof press, ink type, fastens sheet of paper to press roller, and pulls roller over form to make proof copy.

7. Reads proof for errors and clarity of impression.

8. Corrects errors by resetting type and improves impression by tapping face of type with hammer

9. Positions form on bed of press and tightens clamps, using wrench.

10. Fills ink fountain and moves lever to adjust flow of ink.

11. Sets feed guides according to size and thickness of paper.

12. Runs proof sheet through press and examines sheet for clarity of impression.

13. Pushes button to start press, examines printed sheets, and adjust press when printing is defective.

14. Cleans ink rollers at end of run.

JOB TITLE: Engraver
D.O.T. No.: 979.381.010

Major Job Function:

Engraves lettering or designs in copper or steel printing plates, using pantograph engraving machine.

Job Duties:

1. Rubs blank plate with emery or charcoal and oil to polish surface.

2. Clamps blank plate in position under diamond cutting point and master plate under tracing point of pantograph.

3. Starts electric motor that revolves cutting point and lowers engraving control bar, simultaneously moving bar sideways until tracing point enters desired figure on master plate.

4. Moves bar so that tracing point follows figure on master plate, reproducing figure on blank plate.

5. Loosens thumbscrews and changes position of pantograph bar to reproduce figures larger or smaller than those on master plate.

6. May be designated according to type of plate used as copper plate engraver and steel plate engraver.

JOB TITLE: Graphic Arts Technician
D.O.T. No.: 979.382.018

Major Job Function:

Reproduces and assembles graphic arts materials performing any combination of the following tasks.

Job Duties:

1. Operates machine to type master copies, such as stencils, tracings, direct plates, and photo-offsets in preparation for line copy reproduction.

2. Operates offset-duplicating machine to reproduce single or multicolor copies of line, drawings, graphs, or similar materials.

3. Sets up and operates various type cameras to produce plastic or paper plates, and negatives for later use in preparation of aluminum plates for reproduction in offset lithographic process.

4. Positions material to be photographed, focuses lens, adjusts light, and exposes film to copy for specified period of time.

5. Mixes chemical solutions according to formula, and immerses film in solutions to develop negatives.

6. Positions developed negative under masking sheet in lighted box that allows viewer to see negative through masking sheet.

7. Strips masking sheet according to size and/or shape of image to be printed.

8. Opaques errors and blemishes on negative, using brush and chemicals.

9. Places finished masked negative on aluminum plate, and exposes plate to negative under arc lamp to transfer image to plate, using vacuum frame.

10. Applies chemicals to plate to develop transferred image to be printed.

11. Tends machines that assemble pages of printed material in numerical sequence.

12. Cuts, forms, sews, and glues components to form books, using stapling, drilling and binding machines.

13. Maintains machinery and equipment in operating condition.

JOB TITLE: Screen Printer
D.O.T. No: 979.684.030

Major Job Function:

Prints lettering on objects such as posters, glass, and texting using screen and squeegee.

Job Duties:

1. Sets register guides along edge of printing table at intervals specified for pattern repeat.

2. Pours color paste onto screen and position screen against guides over object.

3. Draws squeegee across screen to press color paste through open portion of screen and print design.

4. Repeats process with different screen for each color in design.

5. Washes screen with water or solvent to remove color paste.

PHOTOGRAPHIC COMMUNICATIONS

INTRODUCTION TO PHOTOGRAPHIC COMMUNICATION AND PHOTOGRAPHIC DESIGN

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of some of the needs for photographic communication; types of photographic media; consideration in selection of media type; advantages and disadvantages; design considerations and basic terminology used in the photographic communications industry.

CONTENT OUTLINE

1. History

2. The need for photographic communication

3. Media types

    a. Photographic printing
    b. Projected media
    c. Videotape

4. Selection Variables

    a. Audience
    b. Equipment
    c. Subject matter
    d. Manner of presentation

5. General consideration for photographic communication

6. Advantages and disadvantages

7. Design considerations

8. Terminology

TEACHER ACTIVITIES:

1. Make transparencies

2. Present information relative to content outline

3. Attend classroom discussions relating to the content outline

4. Arrange a field trip to a local industry involved with photographic communication

STUDENT ACTIVITIES

1. Participate in lecture discussions as defined by the content outline

2. Develop a list of local industries that are directly involved with photographic communication

3. Complete assigned activities

PHOTOGRAPHIC COMMUNICATION

1. Introduction to Photographic Communication and Photographic Design

    a. History
    b. The need for photographic communication
    c. Media types
    d. Selection variables
    e. General considerations for photographic communication
    f. Advantages and disadvantages
    g. Design considerations
    h. Terminology

2. Cameras, Lens and Filters

    a. Types of cameras
    b. Parts of the camera
    c. Camera lens
    d. Camera filters

3. Picture making with automatic cameras

    a. Steps in photography
    b. The instant camera
    c. The self-developing camera
    d. Types of film

4. Camera construction and operation

    a. Camera construction
    b. The pinhole camera
    c. Camera operation
    d. Lens focal lengths

5. Black and white film

    a. Introduction to film
    b. Film speed
    c. Common types of film

6. Film developing

    a. Chemicals involved
    b. Processing methods
    c. Developing procedures

7. Photographic papers

    a. Paper bases
    b. Paper surfaces
    c. Paper texture
    d. Paper tint
    e. Contrast grade and image tone
    f. Emulsions

8. Printing from negatives

   - a. Temperature and time
   - b. Photographic paper
   - c. Proof sheets

9. Enlargements

   - a. Methods of exposure
   - b. Enlarging procedures
   - c. Printing and enlarging techniques

10. Photographic career opportunities

OUTLINE OF CONTENT

I. History of Photography

A. Da Vincia used the camera obscur (an artist's drafting tool) that projected a scene on a flat surface in the 1500's.

B. Daguerre in 1839 was able to produce a permanent image on a negative.

C. In the 1840's William Folbot was able to produce paper-based negatives that could produce paper prints.

D. Richard Maddox developed gelatin based negatives in the 1880's.

E. In 1888 George Eastman (an American) developed a hand camera that had the film loaded inside.

II. Needs for Photograph Communication

1. Explain information
2. Inform people of what is happening (News)
3. Advertising (Retail Sales)
4. Art (Produce something of beauty)
5. Portrait making
6. Telling a story
7. Recording History
8. Identification

III. What types of media are used to communicate photographically?

A. Photographic printing

1. Prints

B. Projected Media

1. Filmstrips
2. Slides
3. Movies
4. Transparencies

C. Videotape

IV. What variables should be considered when selecting a photographic medium?

A. Audience

1. Size
2. Participation
3. Socioeconomic level

4. Age

B. Equipment available, room size, lighting, equipment needed, ease of transporting equipment

C. Subject matter to be presented

D. Presenting the material in an effective manner

1. Is motion necessary?
2. Does it need to be in color?
3. Should more than one medium be combined?
4. Should an audio medium be used to complement the visual material?

E. Budget considerations

1. Time schedule
2. How many times will it be used?
3. Monies available for the project
4. Personnel needed to prepare the presentation
5. Complexity of the presentation

V. What general considerations are involved in photographically communicating?

A. Identifying the concepts or information to be communicated

B. Identifying the variables and constraints involved

C. Analyzing the characteristics of the audience

D. Selecting the best medium (or media) to convey the desired concepts

E. Developing the communication product

F. Making the presentation

G. Obtaining feedback, if any

H. Evaluating the product

I. Revising the product, if necessary

VI. Advantages/Disadvantages

1. Still Photography

Advantages

a. Fairly inexpensive
b. Easy finishing process (cropping, etc. for design purposes)
c. Short production time

d. Can be disseminated to either small or large audiences

Disadvantages

a. Somewhat difficult to attract the viewer's attention, compared to TV and movies
b. Attention span of viewer is fairly short
c. Cannot show movement

2. Slides

Advantages

a. Easy to edit slide series
b. Can be developed in the home (darkroom not necessary)
c. Good to use as instructional aids during lectures

Disadvantages

a. Cannot show movement
b. Requires a semi-dark room or darkroom for presentations
c. Fairly expensive

3. Filmstrips

Same characteristics as slides except in continuous strip. Editing must be done before making the final filmstrip.

4. Movies

Advantages

a. Powerful communicative device
b. Can reach large masses of people
c. Audio medium complements the visual material

Disadvantages

a. Very expensive
b. Requires large production staff

5. TV

Advantages

a. Most powerful communicative device
b. Reaches largest number of people
c. Audio medium complements the visual material

Disadvantages

a. Very expensive

b. Requires large production staff

VII. Design Considerations

1. Principles of Design
    - A. Balance
    - B. Rhythm
    - C. Dominance
    - D. Harmony
    - E. Unity
2. Communicative Approaches (Handout)
    - A. Foreground/Background
    - B. Frame
    - C. Silhouettes
    - D. Selective focus
    - E. Reflections

VIII. Terminology

PHOTOGRAPHY
COMMUNICATIVE APPROACHES
by Ronald Bass

I. Dominant Foreground: contributing background
Dominant Background: contributing foreground

These two techniques shall be treated as one since it becomes more a matter of compositional considerations in locating the main subject. Primary purpose of these two techniques is to make photographers aware of using every inch of space within their negative format.

The portion of dominant interest should have the following factors:

1. the brightest light
2. the sharpest focus
3. the largest proportion of area
4. the greatest interest

All other areas of the picture must contribute information relating subject to its environment. No distracting elements should be allowed to interfere, but should be cropped in the camera by shifting camera angle to a better viewpoint.

In any scene both the rule of thirds in depth should be fully considered in relation to the strongest eye-catcher points. You must be aware of depth of field to maintain acceptable focus where you want it.

II. Frame

Another compositional approach to subject matter based on a much unnoticed way of looking at things we are interested in--over, around, or through objects or openings. In every case of successful framing, the frame itself must be a part of the natural environment of the subject, adding information to the idea you are trying to communicate.

Framing has several purposes:

1. To force the eye into the main subject and keep it there.

2. To add the illusion of depth to spatial relationships.

3. To add interest to an otherwise ordinary subject.

4. To blend the subject into his or its environment by contributing information to the main idea.

5. To identify the subject with a special part of its environment.

Being closely related with other approaches in composition, framing naturally blends itself with other familiar techniques such as silhouettes, contributing foreground, depth and space, reflections, and others. Such blends make a composition even stronger. Depth of field is an important factor in shooting. Fuzzy foregrounds can distract; the points of sharpest focus should be the main subject.

III. Silhouettes

A favorite approach when the levels of reflected light are low, or when a photographer must shoot from the shadow side of a back-lighted subject, silhouettes have certain definite requirements:

1. Backgrounds must be meaningful--furnishing the story for the silhouetted shapes.

2. The silhouettes themselves must convey meaning by the implied action, the positions occupied, the attitudes symbolized.

3. Expose for the lighted background, letting the foreground figures fall within the underexposed range in the range of brightness.

4. Print for full tones in the background to contrast sharply with the graphic black of a silhouette.

Generally speaking, silhouettes are suggestions of ideas that are universally understood, the common ground of human nature. Identities are unimportant. The silhouetted figure symbolizes all of his kind. The idea is important.

IV. Selective Focus

Selective focus is more effective when used on purpose: to separate the subject from a distracting background, reduce busyness, and focus attention exactly where you want it.

The technique is based on similarities in the way the eye operates. Except where the eye can concentrate on a point of focus. The eye accepts out-of-focus planes as visual inattention, and naturally, follows the cue to concentrate on the main subject matter.

Selective focus demands:

1. Shallow depth of field, wide aperture.

2. The closer the camera to the subject, the more shallow the depth of field; the further the subject is from the camera, the deeper the area in acceptable focus.

3. Center of attention should be well lit and in sharp focus.

4. Background should contribute information as a suggestion, not sharply detailed. Surroundings should be related to subject matter, and unrelated distractions cropped out, either in camera or in enlarging.

One of the problems in photography is showing too much in a picture. Selective focus can soft-pedal surroundings, separate the point for attention, and emphasize by contrasting sharpness against blurriness.

V. Reflections

Unusual effects can be obtained with reflections, as this is a way of seeing often overlooked by the average person. Principal purpose in using such a technique is to add spice and variety, offer an unusual viewpoint, and introduce a special feeling.

To use reflections communicatively:

1. The reflecting surface should have a definite relationship with the subject matter. It thus takes on more meaning.

2. Reflections utilize the quality of light to add a new dimension of feeling to a scene (mystery, intrigue, distortion), reflecting moods as well as objects.

3. Technically, light, depth of field, and angle of view are main factors to be considered.

Special problems in focusing are encountered because the reflected subject is not on the surface of the reflector. The point of focus lies beyond the reflecting surface by the same distance as the subject is from the surface. A great amount of depth of field is necessary if you want both the subject and the reflection in acceptable focus.

Reflections are where you find them, if you make yourself aware of them: spoons, bowls, glasses, cars, motorcycles, windows, doorknobs, puddles, pools, wet pavement, etc. The list is as endless as a list of shiny objects would be.

GLOSSARY OF PHOTOGRAPHIC TERMS

1. Adjustable Camera - a camera with manually adjustable distance settings, lens opening, and shutter speeds.

2. Aperture - the lens opening that is controlled by a diaphragm.

3. ASA - These letters, which stand for the American Standards Association, are now used (with a number) to indicate the emulsion speed of film. All American film and meter manufacturers. and most of the European ones, now use ASA figures. These film speeds have now replaced the Weston, GE, Din, and BSI (British) speed designations.

4. Available Light - a system of photography which uses whatever light happens to be available, without resorting to artificial light. This requires fast films such as Tri-X and Royal X Pan, or medium speed films suah as Plus X with speed-increase developers like Promicrol.

5. Between-the-Lens Shutter - a shutter whose blades operate between two elements of the lens, sometimes applied to an iris diaphragm whose blades operate between lens elements.

6. Blurred Negatives - any negative showing indistinct outlines of the image or double outlines is "blurred." This may be due to: (1) a poor lens, (2) camera out of focus, (3) holding the camera in the hands with the shutter speed of less than 1/25 second, (4) object moving too rapidly for shutter speed, and (5) underexposure or underdevelopment.

7. Bounce Flash - light from flash source that reaches the subject after being reflected ("bounced") from a surface such as a ceiling or wall.

8. Camera Angles - various positions of camera in relation to subject. Each angle or position gives a different view or effect.

9. Close-up Lens - any single lens placed in front of any camera lens to permit pictures being made closer to the subject that the camera lens alone will allow.

10. Color Negative Film - film that, when processed, becomes a color negative; used primarily to obtain color prints.

11. Color Reversal Film - film that, when processed becomes a positive color transparency; used primarily to obtain color slides.

12. Darkroom - a light-tight area used primarily for processing films and papers; also used for loading and unloading film holders and cameras.

13. Density - the darkness of the negative (or print) and the amount of light that will pass through it; an overexposed negative is more dense than a normal or underexposed negative.

14. Depth-of-Field - the area in sharp focus; depends upon the size

of the lens opening and the distance from lens to subject.

15. Developer - the solution used to bring out the image on exposed film or photographic paper.

16. Diaphragm - a device such as a perforated plate, or an iris, usually mounted between elements of the lens or right behind the lens, used to control the amount of light that will reach the film. Diaphragm openings are usually marked in f-numbers, but on simple cameras they may also be marked with EV numbers or just "Bright Sun" and "Cloudy Bright." See also: "Iris Diaphragm."

17. Direct Positive - the positive image obtained by exposure in the camera with subsequent chemical treatment to develop and "reverse" the image.

18. Dodger - the process of shading a part of the negative while printing or enlarging.

19. Electronic Flash - a repeatable, brilliant flash source created by an electric condenser discharging instantaneously (1/500 second or less) through the rare gas in a long-life, replaceable flash tube. The condenser recharges from a portable battery or a 110-volt power supply.

20. Emulsion - a thin coating of light-sensitive material, usually silver halide in gelatin, that forms the image on film and photographic papers.

21. Enlargement - a blow-up or print, that is larger than the negative.

22. Exposure Meter - an instrument with photoelectric cell used to measure the intensity of light as an aid to selecting an exposure setting; also called a "light meter."

23. Exposure Setting - the lens opening (f-number) and shutter speed selected to expose the film.

24. Film Speed - the amount of light needed to expose the film properly; it means the same as "exposure index" or ASA number.

25. Filter - a colored glass or other transparent material used over the lens for special purposes, such as making clouds photograph better.

26. F-number - any of the numbers used to mark the diaphragm openings on a camera. These numbers help one get the right film exposure, the numbers actually indicate the ratio of the focal length (distance from the lens to the film) to the effective diameter of the lens (diaphragm openings). For example: f/2.8; f/4; f/5.6; f/8; f/11; f/16.

27. Focal Length - the distance from the lens to a point behind the lens where the light rays are focused when the light comes from a great distance; thus, the distance from the lens to the film when the lens is focused on infinity.

28. Focal Plane - the surface (plane) on which an axial image transmitted by a lens is brought to sharpest focus; the surface occupied by the light-sensitive film or plate in a camera.

29. Focal-Plane Shutter - a black curtain that moves across in front of the film and admits light through a slit; used on single-lens reflex cameras.

30. Glossy - the kind of photographic papers that can be ferrotyped to a high gloss.

31. Grain - a unit of weight common to the avoirdupois, troy and apothecaries' systems. It is equal to 0.64799 gram; there are 437.5 grains to an ounce avoirdupois; 480 grains to the ounce troy; and the ounce apothecary.

32. Graininess - the mottled appearance of a photographic print; caused by the clumping of silver grains during the development of the negative. Graininess becomes more noticeable as faster films are used, as density of the negative increases, and as the prints are enlarged.

33. Hue - that attribute of a color by virtue of which it differs from gray of the same brilliance, and which allows it to be classed as red, yellow, green, blue, or intermediate shades of the colors.

34. Hypo - the common name for an acid hardening fixing bath that is made from sodium thiosulfate, other chemicals and water.

35. Iris Diaphragm - term applied to the adjustable aperture fitted into the barrel of photographic lenses and so called because the contractions of the aperture resemble that of the iris (pupil) in the human eye. It consists of a series of thin metal tongues overlapping each other and fastened to a ring on the lens barrel, the aperture made smaller or larger by turning the ring.

36. Latent Image - the invisible image, registered by light on a sensitive photographic emulsion, which does not appear until development.

37. Lens - in photography, the optical instrument or arrangement of light-refracting elements in group, the whole designed to collect and distribute rays of light in the formation of an image.

38. Lens Speed - the widest diaphragm openings (smaller f-numbers) at which the lens can be used; as an f/3.5 lens.

39. Light Source - for taking pictures--natural or artificial light; for printing negatives--enlarging or printing lamp.

40. Multiple Flash - two or more flash sources used to provide better

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lighting than is possible with a single flash source. These sources may be connected by a cord; or one or more slave units may be used.

41. Negative - the developed film; a reverse image of the subject.

42. Pan or Panchromatic - film sensitization designed to record colors in about the same relative brightness as the normal human eye sees them.

43. Parallax - the difference in the field of view as seen through the view finder and by the lens.

44. Photomontage - a composite picture made by a number of exposures on the same film, by projecting a number of negatives to make a composite print, or by cutting and pasting-up a number of prints and subsequently copying to a new negative, or by any of a number of similar processes.

45. Picture Composition - the arrangement of elements (subject, foreground, background, etc.) in a picture.

46. Polaroid Camera - the arraangement of elements (subject, foreground, background, etc.) in a picture.

47. Positive - the opposite of negative; thus, a finished print.

48. Range finder - a device included on some cameras as an aid in focusing. It measures the distance optically between the camera and the object focused on.

49. Reflectors - reflecting surfaces designed in a variety of shapes, sizes, and materials. Reflectors are used to direct light in a controlled fashion to a specific area.

50. Reflex Camera - a camera so made that the scene to be produced is reflected by a mirror onto a glass, where it can be focused and composed in exactly the same size as the negative. With a single-lens reflex camera, the scene is viewed through the same lens that takes the picture, thus avoiding parallax, with a twin-lens reflex camera, the scene is viewed through the top lens and the picture is taken with the bottom lens.

51. Safelight - a darkroom light that does not affect sensitive photographic materials.

52. Scale - the full range of tones which a photographic paper is capable of reproducing.

53. Solarization - a reversal of the image in a negative or print caused by great overexposure. Partial solarization is often intentionally obtained in a print for mood or pictorial effect.

54. Stop Bath - an acid rinse, usually a weak solution of acetic acid, used between the developer and the acid hardening fixing bath when developing film or paper; it stops development instantly and makes the hypo last longer.

55. Synchronization - (as applied to synchronized flash) the automatic simultaneous operation of a camera shutter with the firing of a flash source. Good synchronization means that the greatest illumination available from the flash occurs when the shutter is wide open.

56. Telephoto Lens - a lens that creates a larger image on the film than a normal lens; a telephoto lens has a longer focal length and a smaller angle of view than a normal lens.

57. Thin Negative - a negative that has been underexposed or underdeveloped or both, so that it appears more transparent than a normal negative.

58. Underexposure - too little light reaching the film, producing a thin negative or an overly dark slide lacking in many or all details.

59. Vignette - the process of regulating the distribution of light in such a way that the image obtained fades out toward the edges, leaving no sharp boundaries.

60. Wide-Angle Lens - any lens that covers an angle of view of about 50 degrees or more.

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READING MATERIALS

Readings for lesson: Some Advantages and Disadvantages
of Photographic Media

Media Criteria Sheet

STUDENT ACTIVITIES

Activity 1

Description: In this activity, students will have the opportunity to develop a systems approach and experience the decision-making processes that must take place when one creates a visual communication product using a photographic medium (or media). The class will be divided into small groups (2 or 3 students per group) and will be given information about the budget and the time limit allowed for the development of a communication product. After this, each group will decide upon a message it wishes to communicate to an audience of its own choosing. Using this information and the specified constraints, each group will develop a systems approach that they feel should be used in making the product. Once this has been done, the class, as a whole, will discuss and analyze the systems approaches developed by each group.

NOTE: During this activity, no product will actually be made. The activity should be centered on decision-making processes, not on the actual production of the product.

MEDIA CRITERIA SHEET

1. What size of audience were these media designed for?
large_____ medium_____ small_____

2. What size of room and facilities are needed to be considered in the selection of these media?

large_____ medium_____ small_____

3. Is motion necessary in these media to cover the subject? Yes_____ No_____ Why or why not?__________________________

4. Was color essential in these presentations? Yes_____ No_____ Why or why not?__________________________________

5. How much audience participation is there in these presentation materials?

6. How much room lighting was needed during the showing of the media?

7. What was the source of sound for these media?

8. Do these media provide for individual study?

9. Are these media easy to store for reuse?

10. What kinds of skill do you think are required for preparation of the materials seen in the presentation?

DISCUSSION: The teacher will now lead the class in a discussion of their answers on the criteria sheet.

CAMERAS, LENSES AND FILTERS

UNIT OBJECTIVES

Upon completion of this unit, the students wil demonstrate basic knowledge of types of cameras available; the parts of a camera; camera lens systems; and filters.

CONTENT OUTLINE:

1. Types of Cameras

    a. Instant
    b. Self Developing
    c. Adjustable
    d. Professional

2. Parts of the Camera

    a. Viewfinder
    b. Lens

3. Camera Lens

    a. Comparison to the human eye
    b. Purpose
    c. Functioning

4. Camera Filters

    a. Filter functions
    b. Filter types
    c. Filter factor

TEACHER ACTIVITIES:

1. Make transparencies.

2. Present information relative to the content outline.

3. Do classroom demonstrations as required.

4. Attend classroom discussion relating to camera types, lens and filters.

5. Prepare student handouts.

STUDENT ACTIVITIES:

1. Participate in lecture discussions pertaining to cameratypes, lens, and filters.

2. Complete lab activities as assigned.

OUTLINE OF CONTENT

I. Types of Cameras

A. "Instant" type camera,(TM-#1)--Same basic design as the very early box camera. A very easy to use camera that is capable of making good snapshots for photo albums. The main disadvantages are: pictures can be enlarged only to a maximum of 5 x 7 because larger prints tend to get blurred, close-ups can not be made, and it is difficult to take pictures in poor light.

The lens of the "instant" camera is fixed and can not be adjusted to improve picture quality.

B. "Self-Developing" type camera--The lens of this camera is fixed and can not be adjusted on most "self-developing" cameras. Some "self-developing" types of cameras can be focused (lens adjusted) by moving the lens by means of a bellows system.

The self-developing camera uses film that contains the chemicals needed to complete the developing process. The film which has been exposed to light (taken) is pulled out of the camera between two rollers which starts the developing process.

C. Adjustable camera--Pictures can be taken up close or far away. The amount of light hitting the film can be controlled in adjustable cameras. The length of time that light strikes the film can also be controlled. By controlling the amount of light and the length of time that it hits the film, pictures can be taken under various conditions. Due to the fact that a very fast shutter speed and large lens opening can be set on an adjustable camera, action shots can also be taken.

1. Single Lens Reflex,Transparency 2--Most popular camera used today and is referred to as the SLR camera. The most popular SLR size is the 35mm film size, but SLR's are available which have different film sizes and shutter systems. The SLR camera is designed so that what is seen through the viewfinder is what appears on the negative. Single lens reflex camera uses prisms and/or mirrors to focus through the lens of the camera.

2. Twin Lens Reflex,Transparency 3--The twin lens reflex camera is a popular adjustable camera. A twin lens reflex camera uses one lens to view the object to be photographed and one lens to allow light through to the film. Twin lens reflex cameras use 120 size film.

D. The other adjustable types of cameras listed below are usually used by professional photographers.

1. Bellows Camera,Transparency 4--The camera could be folded together to make it smaller and protect the bellows.

The bellows camera is focused by moving the lens back and forth. No other lens adjustment could be made.

2. Rangefinder Transparency 5--The focusing of a rangefinder is done by use of a mirror and prism. The two images of the subject are matched for focusing.

3. View Camera-Transparency 6--The use of the view camera began before the Civil War. The back of the camera is a ground glass, which is looked at while the lens is adjusted. Film is placed in the camera after it has been focused. The lens of the view camera is very important because it directly determines the quality of the picture.

4. Motion Picture Cameras--The camera size is given in terms of the film size. The camera sizes in most common use are 8mm and 16mm. Cameras have a means for adjusting the lens of the camera. The film is fed through the camera by a battery operated motor which is started and stopped by pressing and releasing the shutter button. The shutter is also controlled by the same button that controls the motor.

II. The Basic Parts of the Camera Are:

A. Viewfinder--A device on the camera designed to show the subject area that will be recorded on the film.

B. Lens--One or more pieces of optical glass or similar material designed to collect and focus rays of light to form a sharp image on the film.

III. Camera Lens (Transparency 7)

A. The camera lens and the human eye function in much the same way.

a. Eyeball (whole)--Camera box
b. Eye lens--Camera lens
c. Iris--Camera diaphragm
d. Retina--film
e. Eyelid--shutter

B. The lens collects the light rays reflected from a subject and focuses the rays into a sharp image.

C. How the Lens Works

1. The camera lens is made from a piece of glass or plastic, which has two opposite surfaces. The surfaces are either both curved or one is curved and the other is flat.

2. The light reflected from the subject passes through the camera lens. As the light passes through the lens it is bent by the lens. The degree to which the light is bent is controlled by

the lens make up and the surface curvature.

3. Lens that have been properly ground cause all light rays from the same part of an object to meet at a point behind the lens called the focal point. The image becomes sharp at the point where the light rays meet.

IV. Camera Filters

A. Functions

1. A light filter removes or tones down certain light rays.

2. The color of the filter will make that color in the photograph lighter.

3. Filter Factor is the amount that the filter dims the brightness reading of the film making it necessary to use a larger lens opening.

4. Cameras with built-in light meters will tell you the proper lens opening to use.

5. The filter screws into the end of the lens.

B. Types

1. Polarizing - Remove glare caused by sun or by the sun being reflected off objects.

2. Red - Lightens up red colors.

3. Green - Lightens up green colors.

4. Yellow - Lightens up yellow colors.

5. Blue - Lightens up blue colors.

C. Filter Factor

1. The amount the filter dims the view or the amount of light that is withheld from the film.

2. This means that the shutter opening will have to be made larger.

3. A filter factor of X 1 means 1/2 of a stop, a factor of X 2 means 1 stop, and tells how much to open up the lens.

LIGHT AND VISION

by Ronald Bass

THE NATURE OF LIGHT

What is light? The ancient Greeks asked this question and arrived at two possible answers. One answer formed by the Pythagorean school was that light consisted of a steady stream of particles. Aristotle, however, believed that light was composed of waves spreading from a light source in the same manner that waves spread from a rock dropped into a still pond. These theories were a point of controversy until Isaac Newton formulated a particle theory of light called the corpuscular theory based on his research activities. For a hundred years after Newton's death, his theory was believed to be true.

In the middle of the eighteenth century, a scientist named Thomas Young conducted experiments which provided very strong evidence in favor of the wave theory of light. Young's theory made it possible to explain a number of unresolved questions concerning the nature of light. As a result, his theory was subscribed to by a number of scientists.

A discovery in 1887 cast doubt upon the complete validity of either theory. This discovery was the observation that a clean zinc plate exposed to ultraviolet light acquired a positive electrical charge. Furthermore, it was found that the amount of electrical charge was proportional to the frequency of the light striking the plate. Neither the wave theory, nor the corpuscular theory adequately explained this phenomena.

In 1905, Albert Einstein speculated that light might be both a wave (wave theory) and a particle (corpuscular theory). He based his ideas on Max Planck's quantum theory. Einstein called light particles traveling in waves a light quantum but later they were named photons. The final answer to the controversy surrounding the nature of light came from a complex physical theory called quantum mechanics developed by a number of the greatest physicists of the twentieth century, including Max Planck, Niels Bohr, Max Born, and others. In general, this theory identifies light as one small portion of the entire electromagnetic wave spectrum and explains how light has the characteristics of high speed particles and waves. Thus, light is composed of photons traveling in waves through all types of media.

THE VISIBLE LIGHT SPECTRUM

Probably the most obvious characteristic of visible light is the variety of colors that we see. The two extremes of color in light are darkness (the absence of light) and white (the presence of all colors of light). It can be shown that there are three basic colors of light: they are green, blue and red. The subtraction of green and blue light from white light will produce red light; the subtraction of green and red light from white light will produce blue light; and the subtraction of blue and red light from white light will produce green light. It is interesting to note that the three primary colors of light are not the same as the primary colors of paint pigments (red, yellow, blue).

Most of the light that strikes the eyes of an observer is reflected from a primary light sources such as the sun. Almost everything that light strikes reflects a certain amount of it. Smooth shiny surfaces, such as mirror, reflect almost all of the light striking them. Light bounces in many ways, but it always follows one rule; the angle of incidence is equal to the angle of reflection. That is, light is reflected from an object at an angle equal to the angle with which it hit the object.

Light not only bounces from surfaces, it goes through some of them. When this occurs, the light may slow down or speed up and, as a result, a slight change of direction takes place. In the air, light travels at 186,000 miles per second, but in water, is reduced by one-fourth. Glass reduces the speed by one-third. This phenomenon is called refraction. But for refraction to occur, the light must strike the new medium at an angle. The greater the angle of incidence the greater the amount of refraction. The refraction of light creates mirages, rainbows, and makes it possible to correct faulty human vision with eye glasses.

If you toss a rock into a pond a series of ripples or waves flow out in all directions. If these waves encounter an obstacle such as a rock, the part of the wave striking the very edge of the rock sets up a new series of waves. Some of these new waves will fan out around the edge of the rock. The waves actually turn the corner. This phenomenon also occurs with light and is called diffraction. When the waves of light from a distant source strike an opaque object, they turn the corner in much the same manner as the waves in water.

On a very clear, bright summer day you may find yourself squinting in order to see better. You do this because your eyes are receiving about ten times as much light as they need. Such concentrations of light, called glare, often result simply from intense sunlight, but more often it is caused by sunlight reflecting off surfaces such as water, pavement or automobiles. The light reflected from these objects is often made up primarily of horizontal light waves and is called polarized glare. Such glare can be virtually eliminated by sunglasses with polarized lenses. These lenses contain a tinted plastic filter with tiny slats like those in a picket fence. The annoying glare is blocked by these slats. However, enough light in the form of vertical waves passes through the lenses to allow the wearer to see clearly.

Certainly one of the most astonishing discoveries about light is that is is made up of tiny particles called photons. If a tremendously magnified beam of light (a barrage of photons) strikes a surface and passes on their energy to surface electrons, a number of them will break off and streak away. These electrons with energy to burn can be harnessed to produce electricity that can move the needle of a light meter or signal a supermarket door to open. This effect had puzzled scientists for years, until Albert Einstein was able to explain it in 1905.

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VISION

The human eye is an astonishing complex biological camera. It makes the most complex camera seem simple by comparison. At the front of the eye is the cornea which protrudes from the opaque white of the eye and is composed of transparent tissue. The cornea bends light and focuses it partially before it reaches the lens. Beneath the cornea is a clear fluid named the aqueous humor which also aids the focusing process. Next in order is the iris with its diaphragm hole, the pupil. The iris governs the amount of light entering the eye by increasing or decreasing in size as light requirements dictate. The lens of the human eye is next in sequence. It performs the find focusing of images for projection to the retina. The inside of the eye is filled with a jelly-like substance known as the vitreous humor which maintains the fine focus of the lens. The backside of the eye is called the retina and is covered with light sensors known as rods and cones. The cones are the receptors for bright light and the rods are receptors for dim light. The rods are not sensitive to colors, which partially explains why objects in dim light appear to be gray or black.

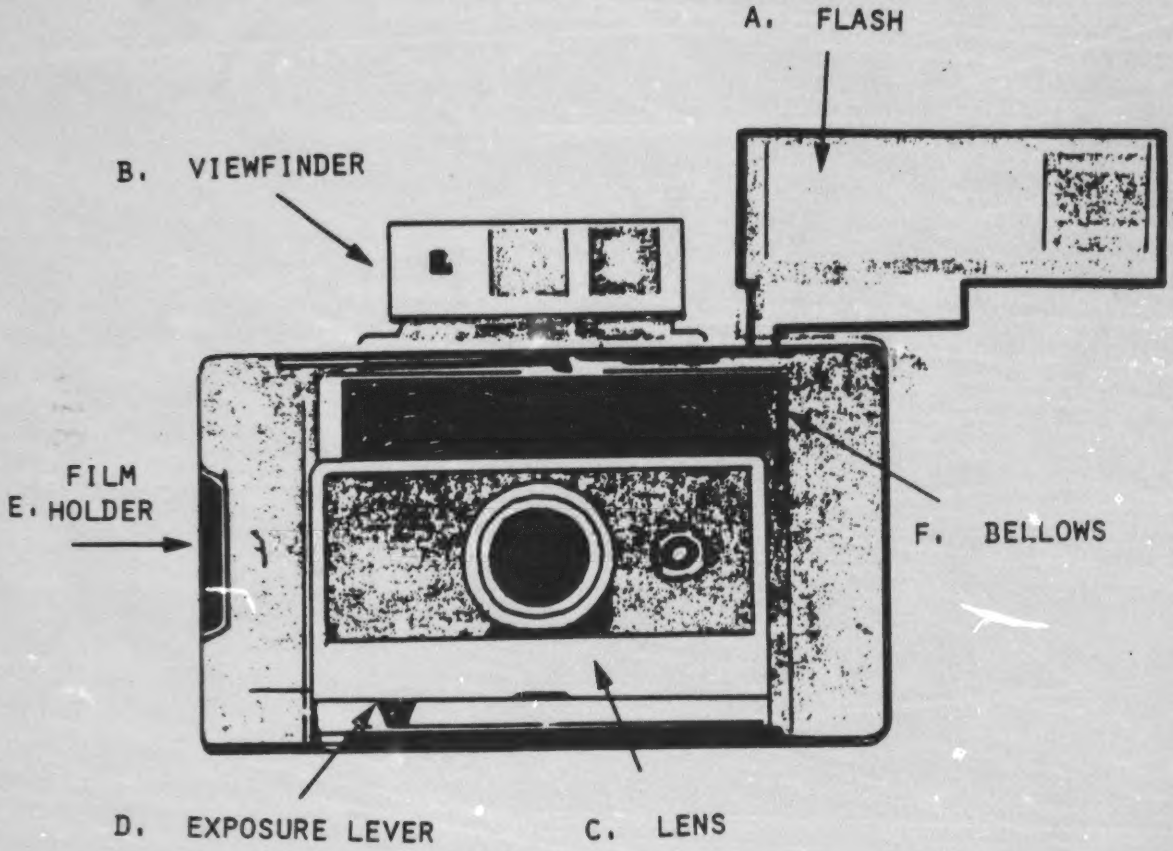
The visual image entering the eye made up of light energy strikes the retina and is converted into electrical energy by a complex electro-mechanical action. The electrical stimulus then travels to the optic nerve through the retinal nerve network. This network converges in the optic nerve which leads to the optic chiasma. Here each optic nerve forms two branches. One branch, from the nasal side of the right eye, joins the branch from the outer side of the left eye. The other branch, from the nasal side of the left eye and the outer side of the right eye, also combine. The two newly formed nerves then travel to the lateral geniculate bodies located just back of the brain's midsection of the left and right sides. The lateral geniculate body is a laminated material and is organized to receive signals from only one of the two eyes. Because of the close proximity of the layers, there is some interaction between signals from each eye. This interaction may be one of the reasonsthat humans have stereoscopic vision. The newly formed nerves then carry the visual stimulus to the visual cortex where the actual phenomenon of sight takes place.

Assignment Sheet #1

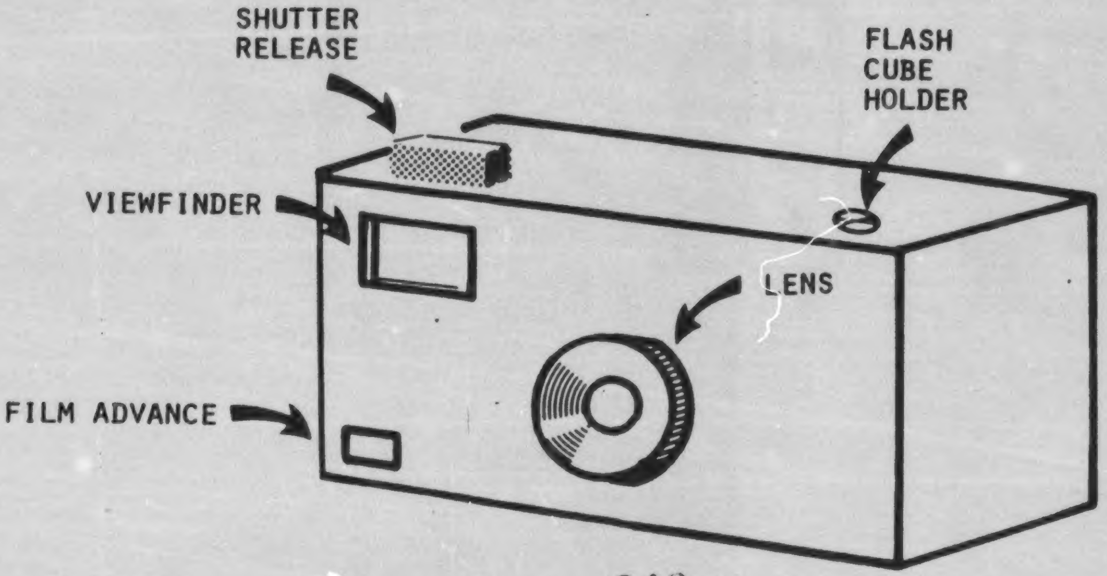
Learning About Your Camera

Each student will bring to class the type of camera he has at home. Each student will become familiar with the parts and operation of the camera. Students should learn how to load film into their respective cameras

SELF DEVELOPING CAMERA


A. FLASH
B. VIEWFINDER
FILM
E. HOLDER
F. BELLOWS
D. EXPOSURE LEVER
C. LENS

INSTANT TYPE CAMERA


SHUTTER RELEASE
FLASH CUBE HOLDER
VIEWFINDER
LENS
FILM ADVANCE

Demonstration #1

How to Use Your Camera

Objective

Each student should learn how to use the camera that is available for him to use.

Materials

Each student should bring to school whatever camera that is available to him/her at home.

Procedure

1. The instructor will show each student how to load film into the camera.

2. Students will also learn the function of the parts of the camera that will be used.

Principle

Students should learn how to operate the camera from observing the instructor during the demonstration. To successfully take pictures the students must know the purpose of each part of the camera.

Student Activity #1

LOADING FILM

Objective

You will take the materials given and correctly complete the following:

1. Load film into your camera;

2. Tell the function of each camera part.

Materials

1. The student furnished camera;

2. A roll of black and white film for the student furnished camera.

Procedures

1. Have instructor watch as you complete the activity;

2. Open the camera back by pressing the button which releases the camera back;

3. Place film in the camera;

   a. Cartridge film is ready for use;
   b. Film that has to have a leader (35mm) must be threaded onto film advance.

4. Close camera back;

5. Explain the function of each camera part.

Information Sheet #2

Filter Terms and Definitions:

Filter - A glass or plastic disk which screws into the front of the lens and helps remove some of a particular color as its rays enter then lens.

Filter Factor - The amount of light that a filter keeps from entering the lens. The filter factor written on the filter tells how much to open the lens to compensate for the filter. Example: x 2 on the filter means to open the opening one stop F28 - F4 - F5.6 - F8.

Polarizing Filter - A filter that removes the harshness and glare caused by bright sunlight.

Student Activity #2

USING FILTERS

Objective:

You will take the materials given and complete the following: use each of the filters to take an exposure of the same object and evaluate the results.

Materials:

1 - 35mm SLR camera

1 - tripod

1 - light meter

1 - set of filters (include blue, green, yellow, red, and polarizing)

1 - shutter release cable

1 - roll of Plus-X Pan film

Procedure:

1. Load camera with the film making sure the proper speed is properly set.

2. Three students will use the same camera and film.

3. Expose the film without the use of a filter.

4. Use the same setting and objects as used for the original exposure except use each of the filters.

5. Set the opening of the lens according to the recommendations on the filter.

TEST 1

Match the terms on the right to the correct description.

1. ____ was the American who developed a hand-held camera that had the film in it.

2. ____ was able to produce a permanent image on a negative.

3. ____ used the camera obscurer as a photographic tool.

4. ____ developed a gelatin based negative.

5. ____ produced a paper-based negative that could produce paper prints.

A. Talbot

B. Daguerre

C. Maddox

D. Da Vincia

E. Eastman

TEST 2

Match the parts of the eye to the parts of the camera which serve the same function.

Eyeball (whole)

Eye lens

Iris

Retina

Eyelid

Shutter

Camera Diaphragm

Camera Lens

Film

Camera Box

TEST 3

Match the names on the right to the diagrams of the cameras on the following page.

A. ______________________________

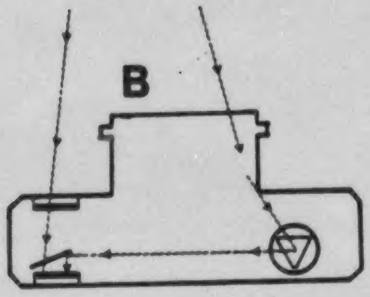
B. ______________________________

C. ______________________________

D. ______________________________

E. ______________________________

2. Bellows
4. Rangefinder
1. Twin Lens Reflex
5. Single Lens Reflex
3. Instant



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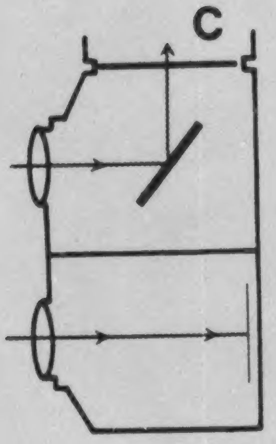

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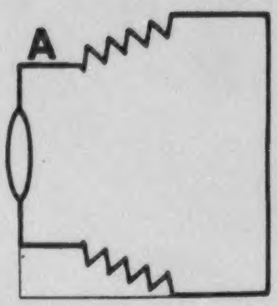
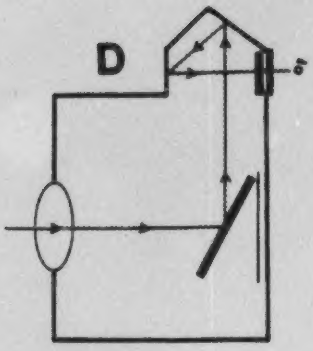
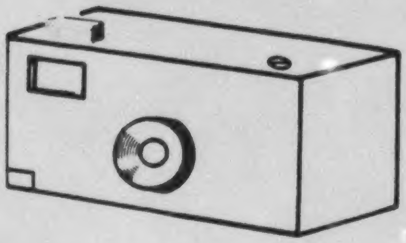


A



D



E

ANSWERS TO TESTS

TEST 1

1. E   2. B   3. D   4. C   5. A

TEST 2

Eyeball (whole)--Camera Box

Eye lens--Camera Lens

Iris--Camera Diaphragm

Retina--Film

Eyelid--Shutter

TEST 3

A. 2   B. 4   C. 1   D. 5   E. 3

TEST 4

Match the terms from the types of filters with the description which best describes the term. Place the letter of your answer in the blank before each statement.

_____1. A glass or plastic disk which screws into the front of the lens and helps remove some of a particular color as its rays enter the lens.

_____2. A _____ filter that removes the harshness and glare caused by bright sunlight.

_____3. The amount of light that a filter keeps from entering the lens.

A. Filter Factor

B. Filter

C. Polarizing

ANSWERS TO TEST 4

1. B

2. C

3. A

REFERENCES/RESOURCES

I. References

A. Gerace, Philip G., and Mangoine, Stephen S. Communication: Photography, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976.

B. Lathrap, Irvin, and La Cour, Marshall. The Basic Book of Photography, Chicago, Illinois: American Technical Society, 1979.

C. Kodak Pocket Guide to Good Pictures, Rochester, New York: Kodak Consumer Markets Division, No. AE-5.

II. Resources

A. Objective sheet.

B. Information sheet.

C. Transparency masters

1. TM1 - "Instant" Type Camera
2. TM2 - Single Lens Reflex
3. TM3 - Twin Lens Reflex
4. TM4 - Bellows Camera
5. TM5 - Rangefinder Camera
6. TM6 - View Camera
7. TM7 - Eye Camera Comparison

D. Assignment Sheet #1--Learning about your camera.

E. Demonstration #1--Show each student how to use his camera.

F. Student Activity #1--Load film into your camera and take pictures.

EQUIPMENT/SUPPLIES

I. Equipment

- A. 8 - 35mm SLR cameras
- B. 8 - tripods
- C. 8 - light meters
- D. 8 - shutter release cables
- E. 8 - sets of filters for the above cameras

II. Supplies

- A. 8 - rolls of Plus-X Pan Film

I. Equipment

- A. Student supplied cameras

II. Supplies

- A. Student supplied film
- B. 24 - *Kodak Pocket Guide to Good Pictures,* Rochester, New York: Kodak Consumer Markets Division, No. AE-5.

PICTURE MAKING WITH AUTOMATIC CAMERAS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the steps in photography; parts of automatic cameras and the film associated with this type of camera.

CONTENT OUTLINE:

1. Steps in photography.
2. Parts of the instant camera.
3. Parts of the self developing camera.
4. Film.

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Attend classroom discussions relative to the content outline.
4. Do classroom demonstration as required.
5. Prepare student handouts.

STUDENT ACTIVITIES:

1. Participate in lecture discussions as defined by the content outline.
2. Complete assigned lab activities.

OUTLINE OF CONTENT

I. Steps in Photography

1. Keep the camera lens clean and hold the camera steady.
2. Choose colorful subjects and objects to be photographed.
3. Move close to the object to be photographed.
4. Pictures should look natural, not posed.
5. Make sure foreground and background adds to the picture.
6. Use trees, rocks, and other natural and man-made objects to frame your picture.
7. Be sure not to let the center of interest in the picture get lost in the background.
8. Make pictures more interesting by changing angles.
9. To get grass, water, etc. try a lower camera angle.
10. Change the mood by using different methods of lighting the scene.
11. On dark days or in deep shade, brighten the subject by using a flash.
12. On bright days move people into a bit of shade.
13. Use a flash inside except with very fast film (e.g. 400 ASA).
14. Use several pictures to tell a story instead of just one.
15. Include pictures of the advertising signs or gates for places visited to add interest.
16. Capture action shots by:
    a. Having action subjects come toward you.
    b. Stop action at its peaks.
    c. "Pan" action by moving camera to follow movement.
    d. On camera with adjustable shutter speeds, use a higher shutter speed.

II. Parts of the Instant Camera (Transparency #1)

Demo #1 - Show how to load and operate the Instant camera

A. Viewfinder

B. Shutter Release

C. Flash Cube Holder

D. Film Advance

E. Lens

III. Parts of the Self-Developing (Polaroid) (Transparency #2)

Demo #2 - Show students how to load and operate the self-developing camera.

IV. Film

A. Cartridge

B. Self-Developing

I. Terms and Definitions for Instant Cameras.

A. Viewfinder - A window which is connected to the lens and lets the camera operator see what will show up on the film.

B. Shutter Release - The button that causes the shutter to be tripped and allows the picture to be taken.

C. Flash Cube Holder - The holding device that holds the flash cube which produces better lighting for a picture under poor lighting conditions.

D. Film Advance - The lever which controls the movement of film from an exposed frame forward to an unexposed frame.

E. Lens - The glass opening which reduces the image to film size and focuses a clear and sharp picture on the film.

F. Aperture - Lens opening. The opening in a lens system through which light passes. The size of the aperture is limited on these cameras.

Information Sheet #2

I. Terms and Definitions for Self-Developing Camera.

A. Viewfinder - A window which is connected to the lens and lets the camera operator see what will show up on the film.

B. Shutter Release - The button that causes the shutter to be tripped and allows the picture to be taken.

C. Flash Cube Holder - The holding device that holds the flash cube which produces better lighting for a picture under poor lighting conditions.

D. Film Advance - The lever which controls the movement of film from an exposed frame forward to an unexposed frame.

E. Lens - The glass opening which reduces the image to film size and focuses a clear and sharp picture on the film.

F. Aperture - Lens opening. The opening in a lens system through which light passes. The size of the aperture is limited on these cameras.

II. Film develops in the following way:

A. Film has the chemicals needed to cause the film to develop.

B. Film is pulled between two rollers.

C. Rollers cause the developing chemicals to be mashed on the film and start the developing process.

D. Hold the picture, expose it to light or remove protective paper (if it has it).

Demonstration #1

LOADING AND OPERATING AN INSTANT CAMERA

Objective:

To show students how to properly load and shoot quality pictures with an instant camera and remove the film.

Materials:
1 - "Instant" type camera
1 - cassette (cartridge) of 110 or 126 film

Procedure:

1. While holding the camera in the left hand, push the button on the side of the camera body to release the catch which holds the back closed.

2. Open the camera back and place the film cartridge into the camera following the instructions on the cartridge.

3. After the film has been placed in the camera, you are ready to take pictures.

4. To take pictures:

    a. Pick out the objects, people or scene to be photographed.
    b. Look through the camera viewfinder to find the most pleasing arrangement of what is to be photographed.
    c. After the most pleasing arrangement of the object to be photographed has been seen in the viewfinder, push the shutter release button while holding the camera still.
    d. Push the film advance to advance to the next frame.
    e. You are now ready to take the next picture.
    f. Repeat steps a through e.

5. After the cartridge of film has been used up, unload the cartridge from the camera by following these steps:

    a. Place camera in left hand.
    b. Push the button on the side of the camera body to release the catch on the back.
    c. Open the camera back and remove the film cartridge.

6. Take the film cartridge to be developed.

Principle:

An instant camera is a lighttight box with a lens which controls the light which reaches the film. The lens has a shutter behind it and is opened by pressing the shutter release allowing the light rays to strike the film.

Demonstration #2

LOADING AND OPERATING THE SELF-DEVELOPING CAMERA

Objective:

To show students how to properly load, shoot and develop pictures using the self-developing camera.

Materials:

1 - Self-Developing camera
1 - cassette (cartridge) of self-developing film for above camera

Procedure:

1. While holding the camera in the left hand, push the button on the side of the camera body to release the catch which holds the back closed.

2. Open the camera back and place the film cartridge into the camera following the instructions on the cartridge.

3. After the film has been placed in the camera, you are ready to take pictures.

4. To take pictures:

   a. Pick out the objects, people or scene to be photographed.
   b. Look through the camera viewfinder to find the most pleasing arrangement of the object to be photographed.
   c. After the most pleasing arrangement of the object to be photographed has been seen in the viewfinder, push the shutter release button while holding the camera still.
   d. Pull the previously taken picture through the developing rollers to the outside of the camera so the developing chemicals will start the developing process on the film by being spread on the film.
   e. If the picture has a paper cover on it, remove the paper covering.
   f. Film not having a paper cover develops after being removed from the camera.
   g. You are now ready to take the next picture.
   h. Repeat steps a through f.

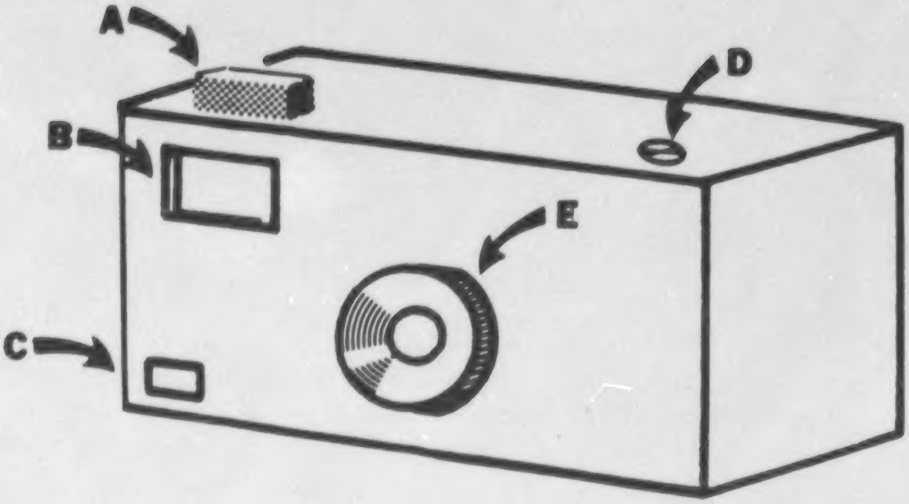
5. After all the pictures have been taken, open the camera back and remove the empty cartridge.

Principle:

A self-developing camera is a lighttight box with a lens which controls the light which reaches the film. The lens has a shutter behind it which keeps light from striking the film until the desired picture is seen in the viewfinder. The shutter is opened by pressing the shutter release allowing light rays to strike the film. The film is then pulled between two rollers which causes developing chemicals on the film to be spread over the film which starts the developing process. The picture develops outside the camera.

Assignment Sheet #1

Identify the parts of the instant camera in this picture.



A. ______________________

B. ______________________

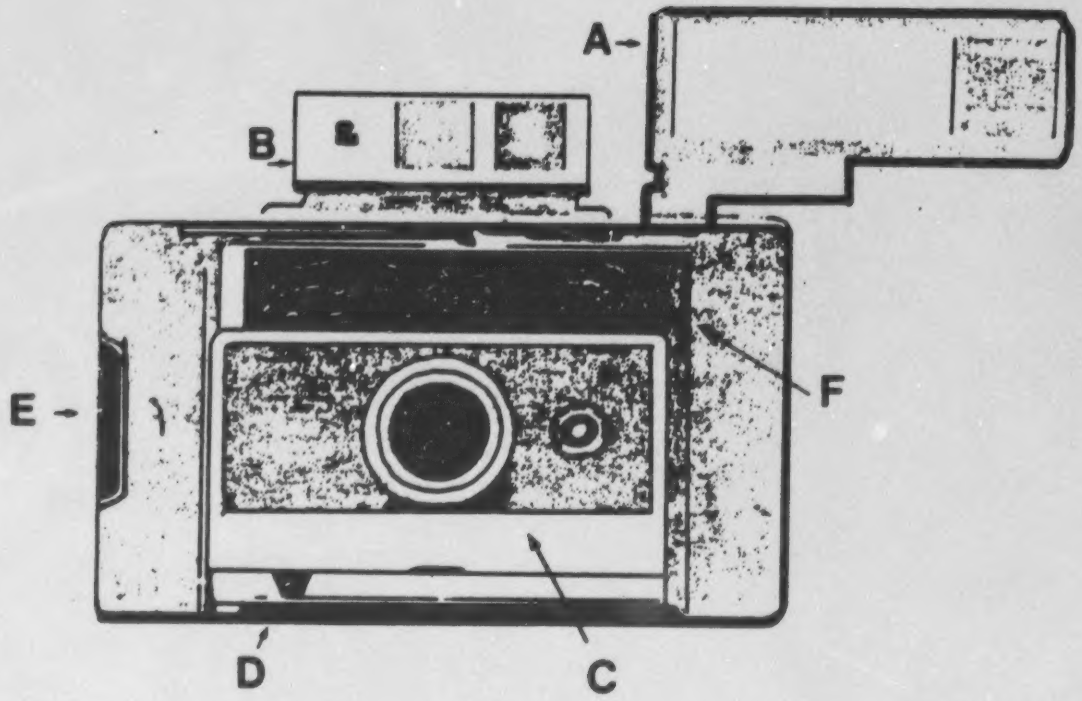
C. ______________________

D. ______________________

E. ______________________

F. ______________________

Identify the parts of the self-developing camera in this picture.



A. ______________________

B. ______________________

C. ______________________

D. ______________________

E. ______________________

F. ______________________

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Student Activity #1

TAKING PICTURES WITH YOUR CAMERA

Objective:

You will take the materials given and correctly complete the following:

1) Load the film cartridge into the instant camera;

2) Take pictures; and

3) Remove film cartridge using your camera.

Materials:

1 - "Instant" type camera
1 - cassette (cartridge) of 110 or 126 film

Procedure:

1. While holding the camera in the left hand, push the button on the side of the camera body to release the catch which holds the back closed.

2. Open the camera back and place the film cartridge into the camera following the instructions on the cartridge.

3. After the film has been placed in the camera, you are ready to take pictures.

4. To take pictures:

    a. Pick out the objects, people or scene to be photographed.
    b. Look through the camera viewfinder to find the most pleasing arrangement of what is to be photographed.
    c. After the most pleasing arrangement of the object to be photographed has been seen in the viewfinder, push the shutter release button while holding the camera still.
    d. Push the film advance to advance to the next frame.
    e. You are now ready to take the next picture.
    f. Repeat steps a through e.

5. After the cartridge of film has been used up, unload the cartridge from the camera by following these steps:

    a. Place camera in left hand.
    b. Push the button on the side of the camera body to release the catch on the back.
    c. Open the camera back and remove the film cartridge.

6. Take the film cartridge to be developed.

Principle :

An instant camera is a lighttight box with a lens which controls the light which reaches the film. The lens has a shutter behind it and is opened by pressing the shutter allowing the light rays to strike the film.

Objective:

You will take the materials given and correctly complete the following:

1) Load the film cartridge into the camera;

2) Take pictures; and

3) Cause the film to start self-development with your own camera.

Materials:

1 - Self-Developing Camera (student owned)
1 - Cassette (cartridge) of self-developing film for above camera

Procedure:

1. While holding the camera in the left hand, push the button on the side of the camera body to release the catch which holds the back closed.

2. Open the camera back and place the film cartridge into the camera following the instructions on the cartridge.

3. After the film has been placed in the camera, you are ready to take pictures.

4. To take pictures:

a. Pick out the objects, people or scene to be photographed.
b. Look through the camera viewfinder to find the most pleasing arrangement of the object to be photographed.
c. After the most pleasing arrangement of the object to be photographed has been seen in the viewfinder, push the shutter release button while holding the camera still.
d. Pull the exposed film through the developing rollers to the outside of the camera so the developing chemicals will start the developing process on the film by being spread on the film.
e. If the picture has a paper cover on it, remove the paper covering.
f. Film not having a paper cover develops after being removed from the camera.
g. You are now ready to take the next picture.
h. Repeat steps a through f.

5. After all the pictures have been taken, open the camera back and remove the empty cartridge.

Principle:

A self-developing camera is a lighttight box with a lens which controls the light which reaches the film. The lens has a shutter behind it which keeps light from striking the film until the desired picture is seen in the viewfinder. The shutter is opened by pressing the shutter seen in the viewfinder. The shutter is opened by pressing the shutter release allowing light rays to strike the film. The film is then pulled between two rollers which causes developing chemicals on the film to be spread over the film which starts the developing process. The picture develops outside the camera.

ANSWERS TO TESTS

TEST 1

A. Shutter Release

B. Film Advance

C. Flash Cube Holder

D. Viewfinder

E. Lens

F. Apertue

TEST 2

A. Aperture

B. Lens

C. Flash Holder

D. Shutter Release

E. Viewfinder

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EQUIPMENT/SUPPLIES

I. Equipment

   A. 1 - Instant Camera

   B. 1 - Self-Developing Camera

II. Supplies

   A. 1 - cartridge of 110 or 126 film

   B. 1 - cartridge of self-developing film

   C. 4 - bottles of lens cleaning fluid

   D. 4 - packages of lens cleaning tissue

CAMERA CONSTRUCTION AND OPERATION

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of camera construction and operation; to include identification of parts; viewing; lens openings; focusing; depth of field; and lens focal lengths.

CONTENT OUTLINE:

1. Camera Construction
    a. Parts
    b. Shutter types
    c. Shutter speed and lens openings
2. The Pinhole Camera
3. Camera Operation
    a. Viewing
    b. Lens opening
    c. Focusing
    d. Depth of field
4. Lens Focal Lengths

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to content outline.
3. Do classroom demonstration as required.
4. Attend classroom discussions relating to the content outline.
5. Prepare student handouts.

STUDENT ACTIVITIES:

1. Participate in lecture discussions defined by the content outline.
2. Construct a pinhole camera.
3. Complete lab activities as required.

OUTLINE OF CONTENT

I. Camera Construction

A. Parts of the Camera (Transparency #1)

1. Shutter speed dial
2. Advance lever
3. Shutter release
4. Frame counter (automatic reset exposure counter)
5. Timer (self-timer cocking lever)
6. Focusing ring
7. Flash terminal
8. Preview button
9. Viewfinder
10. Rewind knob
11. Rewind Crank
12. Hot shoe
13. Lens
14. Body

B. Shutter Types (Transparency #2)

1. Leaf Shutter

2. Focal Plane

C. Shutter Speed-Lens Opening (Transparency #3)

1. As you go to a faster shutter speed the F-stop is opened a stop.

2. As you step down the F-stop, a slower speed is needed.

II. Pinhole Camera (Transparency #4) Demonstration #1 - Show students how to make a pinhole camera.

A. Box type

B. Can type

C. Cartridge

D. Materials

III. Camera Operation

A. Viewing angles of lens (Transparency #5)

1. Wider viewing angles make objects look farther apart.

2. Narrower viewing angles make objects look closer together.

B. Lens Openings (Transparency #6)

1. Large F-stop means a smaller lens opening.

    2. Smaller F-stop means a larger lens opening.

  C. Focusing Systems (Transparency #7)

    1. Coindent (Grids)

    2. Split image

  D. Depth of Field

IV. Lens Focal Lengths

  A. 55mm

  B. 200mm

  C. 200m

Information Sheet #1

I. Terms and Definitions

A. Shutter Speed Dial - An indexed dial which sets the shutter at the desired speed.

B. Advance Lever - The lever which controls the movement of film from an exposed frame forward to an unexposed frame.

C. Shutter Button - The button that causes the shutter to be tripped allowing the picture to be taken.

D. Frame Counter (Automatic reset exposure counter) - Shows how many frames have been exposed.

E. Timer - A device which allows a time period to elapse between the time the shutter button is pushed and the picture taken.

F. Focusing Ring - The movable ring on the lens which adjusts the lens to get pictures in focus.

G. Depth of Field - The focus area of a camera.

H. Depth of Field Preview Button - This button allows the scene to be seen as it looks at a particular F-stop setting (lens setting).

I. Viewfinder - Shows the image that is seen by the lens of the camera.

J. Rewind Knob - Used to rewind film into cartridge after the entire roll of film has been exposed.

K. Rewind Crank - Part of the rewind knob used to rewind film.

L. Hot shoe - The holding device (marked with a red X) on the top of the camera used to hold the electronic flash.

M. Lens - The glass opening which reduces the image to film size and produces a clear and sharp picture on the film. Controls the focusing and F-stop setting of the camera.

1. Wide angle - Make scenes, objects and rooms stretch out to infinity. Has a shorter focal length and a wider field of view than a normal lens.

2. Telephoto - Bring objects which are far away in closer. Has a longer focal length and narrower field of view than normal lens.

3. Normal - Shows the things as they actually are with little distortion.

4. Zoom - A lens which can have its focal length adjusted to cover a wide range.

N. Body - That part of the camera that holds the film and has the other parts of the camera attached to it.

O. F-Stop - The size of the lens opening; this controls the amount of light exposed to the film.

P. Focal length of the lens - The actual distance from the lens to a point behind the lens where light rays are focused when the distance scale is set on infinity. (The distance from the optical center of the lens to the film.)

Q. Shutter - The device which controls the time that the film will be exposed to light.

1. Leaf Shutter - Thin pieces of metal which open and close on a hinged, spring-loaded system.

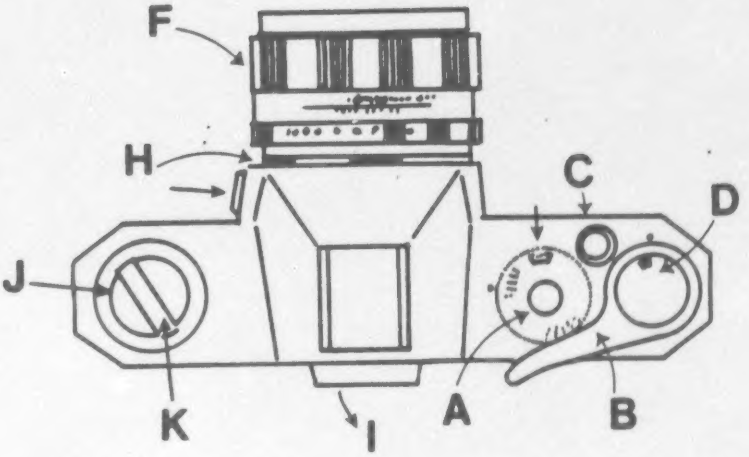
2. Focal Plane Shutter - Two opaque cloth or metal foil curtains separated by a narrow slit.

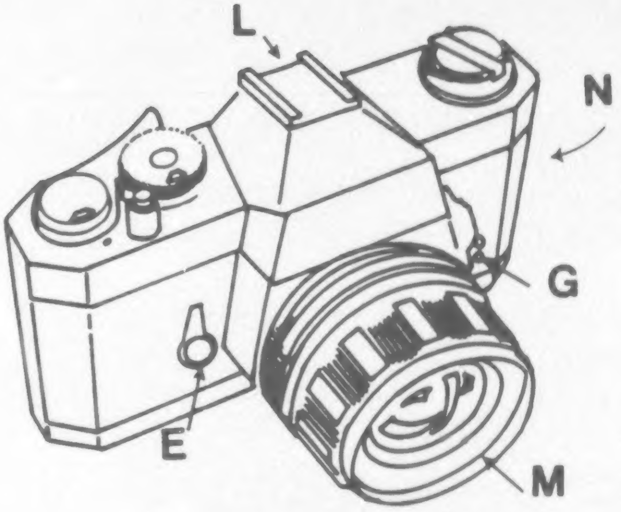
R. Focusing Screens - A device which helps the photographer tell if his picture is in focus.

S. Flash synchronization - The setting of the shutter speed that makes the shutter opening speed and flash duration equal. Marked by an X and the shutter speed dial.

T. Electronic Flash - A battery powered lighting device used to provide more light in poorly lit photographic situations.

PARTS OF THE CAMERA





A. SHUTTER SPEED DIAL

B. ADVANCE LEVER

C. SHUTTER RELEASE

D. AUTOMATIC RESET EXPOSURE COUNTER

E. SELF-TIMER COCKING LEVER

F. FOCUSING RING

G. FLASH TERMINAL

H. PREVIEW LEVER

I. VIEWFINDER

J. REWIND KNOB

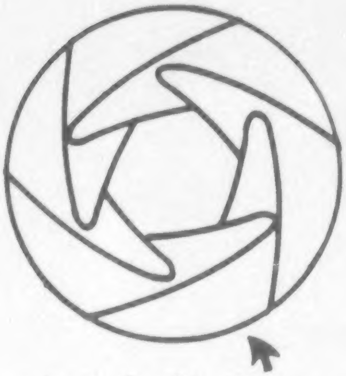
K. REWIND CRANK

L. HOT SHOE

M. LENS

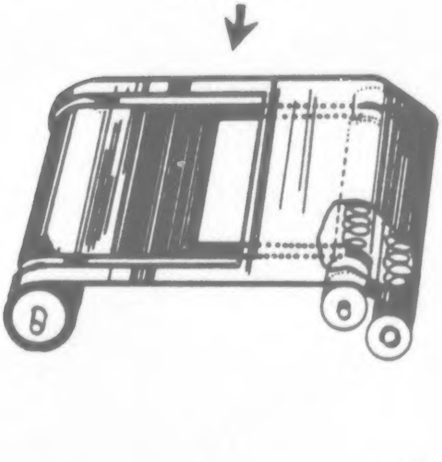
N. BODY

SHUTTER TYPES

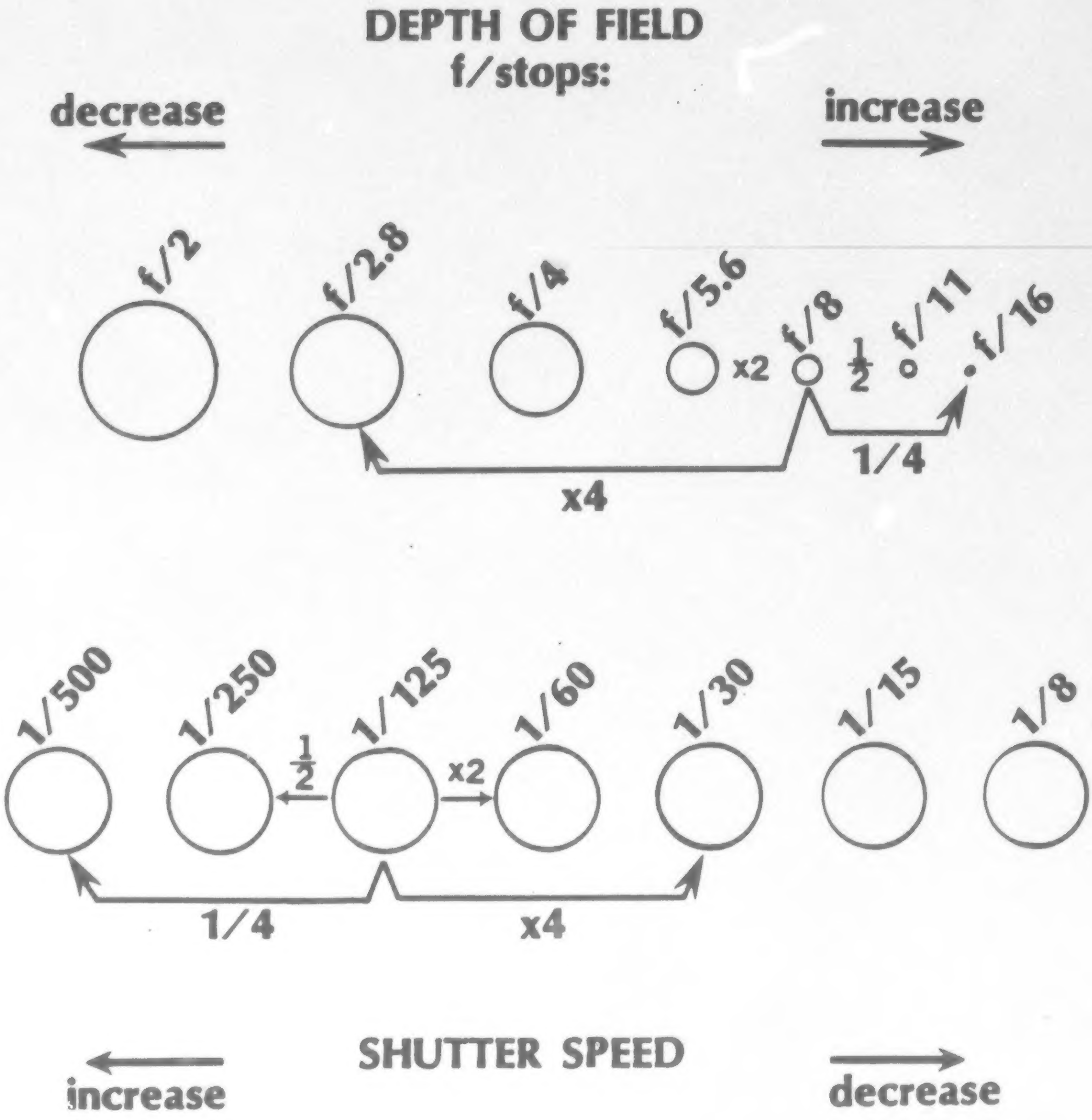


Leaf shutter

Focal plane shutter



SHUTTER SPEED--LENS OPENING


DEPTH OF FIELD
f/stops:
decrease
increase
f/2
f/2.8
f/4
f/5.6
x2
f/8
½
f/11
f/16
x4
1/4
1/500
1/250
½
1/125
x2
1/60
1/30
1/15
1/8
1/4
x4
SHUTTER SPEED
increase
decrease

PINHOLE CAMERA

Materials:

1 Cartridge of 126 Film--Kodak Tri-X Pan

1 Piece of thin black cardboard 1 1/4" X 5 3/4"

1 Piece of rigid black cardboard, 1 1/2" X 2 3/4", with a 1/2" square opening cut in center

1 Piece of heavy aluminum foil, 1 inch square

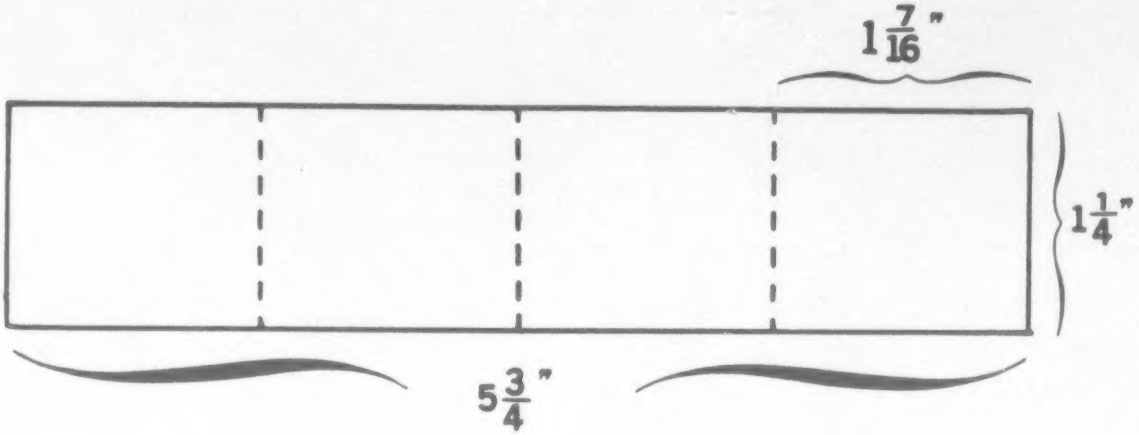
1 Piece of black paper, 1 inch square

1 Wooden tongue depressor

2 Strong rubber bands

1 No. 10 sewing needle

Black masking tape



Demonstration #1

MAKE A PINHOLE CAMERA

Objective:

To make a very simple camera to aid students learn about the principles of the camera.

Materials:

1 - Cartridge of 126 film, Kodak Tri-X Pan

1 - Piece of thin black cardboard, 1-1/4" x 5-3/4"

1 - Piece of rigid black cardboard, 1-1/2" x 2-3/4", with a 1/2" square opening cut in center

1 - Piece of heavy aluminum foil, 1 inch square

1 - Piece of black paper, 1 inch square

1 - Wooden tongue depressor

2 - Strong rubber bands

1 - No. 10 sewing needle

Black masking tape

1 - Utility knife

1 - Pair of scissors

Procedure:

1. Make four 1-7/16" sections on the large piece of black cardboard.

2. Cut through top layer of the cardboard on each line.

3. Fold the cardboard into a box shape.

4. Place black tape on the corners.

5. Make a hole in the center of the aluminum foil with the point of the needle.

6. Center and tape the foil over the opening in the small piece of cardboard.

7. Tape the small piece of black paper over the foil along the top.

8. Tape the cardboard with the hold to the box.
9. Place the camera against the film cartridge.
10. Secure film with rubber bands.
11. Trim tongue depressor to fit film cartridge to advance film.

Principle:

A pinhole camera is a small, lighttight can or box which has its inside painted black. A small hole is punched in the center of one end and the hole is covered to prevent light from hitting the film until the proper time. The hole is aimed at the object to be photographed and the paper over the hole raised allowing the light to strike the film. The light reacts with the silver halides and the film recording the images on the film.

Student Activity #1

Objective:

You will take the materials given and correctly complete the following:

1) Construct a pinhole camera;

2) Expose the film in the camera; and

3) Have the film developed.

Materials:

1 - Cartridge of 126 Kodak Tri-X Pan film

1 - Piece of thin black cardboard, 1-1/4" x 5-3/4"

1 - Piece of rigid black cardboard, 1-1/2" x 2-3/4" with a 1/2" square opening in the center

1 - Piece of heavy aluminum foil, 1 inch square

1 - Piece of black paper, 1 inch square

1 - Wooden tongue depressor

2 - Rubber bands

Black masking tape

No. 10 sewing needle

Utility Knife

Scissors

Procedure - Construct a Pinhole Camera

1. Make four 1-7/16" sections on the large piece of black cardboard.

2. Cut through top layer of the cardboard on each line.

3. Fold the cardboard into a box shape.

4. Place black tape on the corners.

5. Make a hole in the center of the aluminum foil with the point of the needle.

6. Center and tape the foil over the opening in the small piece of cardboard.

7. Center and tape the foil over the opening in the small piece of cardboard.

8. Tape the small piece of black paper over the foil along the top.

9. Place the camera against the film cartridge.

10. Secure film with rubber bands.

11. Trim tongue depressor to fit film cartridge to advance film.

Procedure - Expose the Film in the Camera

1. Point the end of the camera with the hole in it toward object or subject.

2. To properly aim the camera sight over the top of the camera.

3. The camera must be held very still. Support the camera on a table, chair, rack, etc.

4. Lift the cover that is over the hole to expose the film.

5. The exposure time is: In light sun 1/2 to 1 second; cloudy bright 2 to 4 seconds.

6. To get a good picture take three pictures of each scene.

7. Make one picture at the recommended exposure time, one at twice the time and one at one-half the recommended time.

8. After each exposure lower the cover over the hole and hold tightly until you make the next exposure.

Procedure - Have Film Developed

1. Remove film from camera.

2. Take exposed film cartridge to be developed.

Activity Sheet #2

TAKING PICTURES

I. Tools and Materials

- A. Tools
  - 1. 35mm SLR camera with normal lens
  - 2. Electronic flash
  - 3. Tripod
  - 4. Shutter release cable
  - 5. 36 exposure roll of black and white film
- B. Materials
  - 1. Lens cleaning fluid
  - 2. Lens cleaning tissue

II. Procedure

1. Secure tools
2. Buy proper type of film
3. Load film into camera
4. Shoot pictures using the procedures and tools best suited to that situation
5. Unload film after completing the 36 exposures
6. Have film developed

TEST 1

Match the terms on the bottom to the correct definition or description.

___ 1. The focus area of a camera.

___ 2. The device which controls the time that the film will be exposed to light.

___ 3. A battery powered lighting device used to provide more light in a poorly lit photographic situation.

___ 4. The size of the lens opening.

___ 5. The glass opening which reduces the image to film size and produces a clear and sharp picture on the film.

___ 6. That part of the camera that holds the film and has the other parts of the camera attached.

___ 7. Shows how many pictures have been taken.

___ 8. A button which controls the lens and allows the scene to be seen as it looks at a particular F-stop setting.

___ 9. Shows the image that is seen by the lens of the camera.

___10. A device which helps the photographer tell if his picture is in focus.

___11. The holding device for the electronic flash.

___12. The lever which controls the movement of film from exposed to unexposed.

___13. This lens brings images in closer.

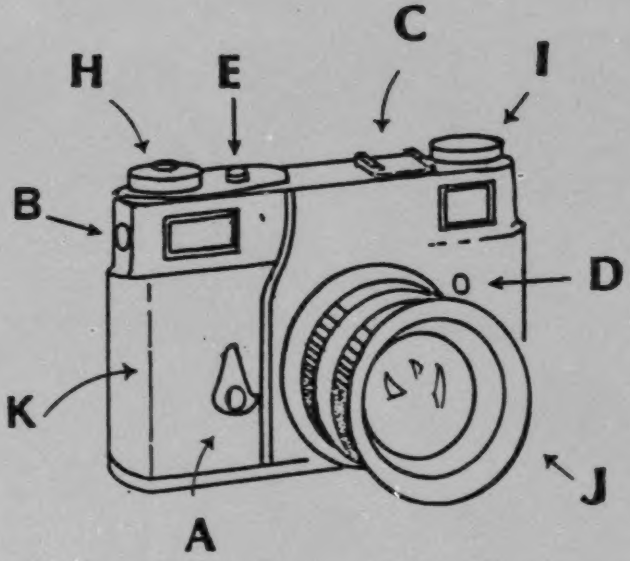
___14. This lens makes scenes, objects, and rooms stretch out to infinity.

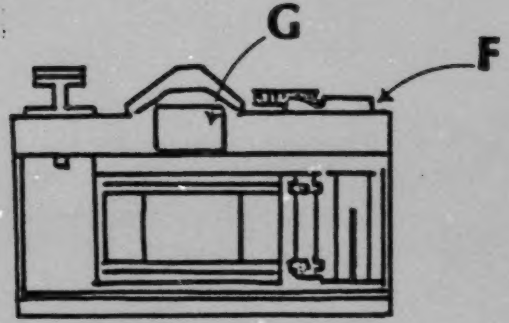
___15. A device which allows a time period to elapse between the time the shutter button is pushed and the picture taken.

A. Electronic flash
B. F-stop
C. Body
D. Depth of field preview button
E. Focusing Screen
F. Advance Lever
G. Wide Angle
H. Depth of field
I. Shutter
J. Lens
K. Frame counter
L. Viewfinder
M. Hot Shoe
N. Telephone
O. Timer

TEST 2

Identify the parts of the camera on the following picture:





A. ______________________

B. ______________________

C. ______________________

D. ______________________

E. ______________________

F. ______________________

G. ______________________

H. ______________________

I. ______________________

J. ______________________

ANSWERS TO TEST

TEST 1

1. H
2. I
3. A
4. B
5. J
6. C
7. K
8. D
9. L
10. E
11. M
12. F
13. N
14. G
15. O

TEST 2

A. Self timer cocking lever
B. Flash terminal
C. Hot shoe
D. Preview button
E. Shutter release
F. Film advance lever
G. Viewfinder
H. Shutter speed dial
I. Rewind knob
J. Lens
K. Body

REFERENCES/RESOURCES

I. References

A. Gerace, Philip G., and Mangiane, Stephen S. Communication: Photography. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976.

B. How to Make and Use a Pinhole Camera. Rochester, New York: Kodak, Consumer Markets Division, No. AA5, 1971.

C. Muse, Ken. Photo One. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972.

II. Resources

A. Objective sheet

B. Information sheet

C. Transparency Masters

1. TM1 - Parts of the Camera.
2. TM2 - Shutter Types.
3. TM3 - Shutter Speed--Lens Opening.
4. TM4 - Pinhole Camera.
5. TM5 - Viewing angle of the lens.
6. TM6 - Lens Opening Sizes.
7. TM7 - Focusing Screens.
8. TM8 - Depth of Field.
9. TM9 - Local Lengths of Lens.

D. Assignment Sheet #1 - Identify the parts of the camera.

E. Demonstration #1 - Make a pinhole camera.

F. Student Activity #1 - Take and have pictures developed with camera.

G. Student Activity #2 - Load, expose and unload one 36 exposure roll of film.

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EQUIPMENT/SUPPLIES

I. Equipment

A. 12 - Utility knives

B. 12 - Pairs of scissors

C. 2 - 35mm SLR cameras

D. 2 - Electronic flashes

E. 2 - Tripods

F. 2 - Light meters

II. Supplies

A. 12 - Cartridges of 126 film, Kodak Tri-X Pan

B. 12 - Pieces of thin black cardboard, 1-1/4" x 5-3/4"

C. 12 - Pieces of rigid black cardboard, 1-1/2" x 2-3/4" with a 1/2" square opening cut in center.

D. 12 - Pieces of heavy aluminum foil, 1 inch square.

E. 12 - Pieces of black paper, 1 inch square.

F. 12 - Wooden tongue depressors.

G. 24 - Strong rubber bands.

H. 12 - No. 10 sewing needles.

I. 1 - Roll of black masking tape.

J. 4 - Bottles of lens cleaning fluid

K. 4 - Packages of lens cleaning tissue.

BLACK AND WHITE FILM

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of black and white film; its composition; the effects of film speed; common sizes and types of film used by the photographic communications industry.

CONTENT OUTLINE:

1. Introduction to Film
    - a. What is film
    - b. How does film work
    - c. Film size

2. Film Speed
    - a. Definition
    - b. Effects of film speed

3. Types of Film
    - a. Panatomic-X
    - b. Plus-X Pan
    - c. Tri-X Pan

TEACHER ACTIVITIES:

1. Make transparencies.

2. Present information relative to the content outline.

3. Do classroom demonstrations as required.

4. Attend classroom discussions relating to the content outline.

5. Prepare student handouts.

STUDENT ACTIVITIES:

1. Participate in lecture discussions as defined by the content outline.

2. Complete lab activities as required.

OUTLINE OF CONTENT

I. Introduction to Film

A. What is film?

Definition: Film is a light-sensitive material that is made up of grains of silver halides suspended in gelatin and coated with an acetate (See TM #1).

1. Silver halides: Silver grains combined with a halogen element for increased sensitivity.

2. Emulsion: Silver halides suspended in gelatin.

3. Acetate: The plastic base of film.

B. How does film work?

1. Light strikes film.

2. Silver halide turns to shades of gray and then black depending on the amount of light striking the film.

3. The brightest light creates the blackest, silver-halide crystals.

4. Negative effect is reversed because bright areas turn black and black areas in the scene remain clear.

5. Antihalation dye: The film coating that keeps the rays of light that pass through the emulsion from being reflected back into the emulsion after they have passed through.

C. Film Size

1. 110 and 126: Usually in lighttight plastic cassette in which unexposed film is in one compartment. As film is exposed it is rolled into the other compartment. Entire cassette is sent to be developed.

2. 135 usually called 35mm: Comes in cassette form but most commonly comes in a roll which must be threaded into camera. Film is rolled back into spool after it is exposed

II. Film Speed

A. Definition: The amount of light needed to make a quality picture on a type of film.

1. ASA - The number giving the speed of the film.

a. Higher ASA number the faster the film.
b. Films with high ASA numbers will work in low light areas.

c. The films with high ASA numbers do not produce quality as good as slower speeds.

2. The faster the film speed, the poorer the picture quality.

B. Effects of Film Speed

1. Contrast - Demo #1 shows examples of contrast.

a. The elimination of some grays of a picture because the film has less clumps of light-sensitive material.

b. A picture taken with high-speed film has fewer tones.

c. The slower the film speed the more gray tones that will show up.

2. Grain - Demo #2 show enlarged pictures

a. Caused by clumps of light-sensitive material in the emulsion.

b. Large spaces between the clumps cause all clumps to react to light coming in contact with the emulsion because they are far apart and not hidden beneath each other.

c. When negatives are enlarged the spaces become more evident.

III. Types of Film

A. Panatomic-X

1. Speed - ASA 32

2. High Contrast

3. Fine Grain

B. Plus-X Pan

1. Speed - ASA 125

2. Good Contrast

3. Fine Grain

C. Tri-X Pan

1. Speed - ASA 400

2. Good Contrast

3. Coarse Grain

I. Terms and Definitions

Film - a light-sensitive material made of grains of silver halides suspended in gelatin and coated onto an acetate strip.

Film leader - a length of protective film at the beginning of a roll of film.

Film speed - the sensitivity of a given film to light, indicated by a number; the higher the number, the more sensitive, or "faster," the film.

Silver halides - silver grains combined with a halogen element.

Emulsion - a thin coating of light-sensitive material, usually silver halide in gelatin, in which the image is formed on film and photographic papers.

Acetate - the plastic base of film which carries the emulsion.

ASA - the number giving the speed of the film.

Graininess - the sand-like or granular appearance of a negative, print or ASA slide resulting from the clumping of silver grains during development of the film; graininess becomes more pronounced with faster films, increased density in the negative, and degree of enlargement.

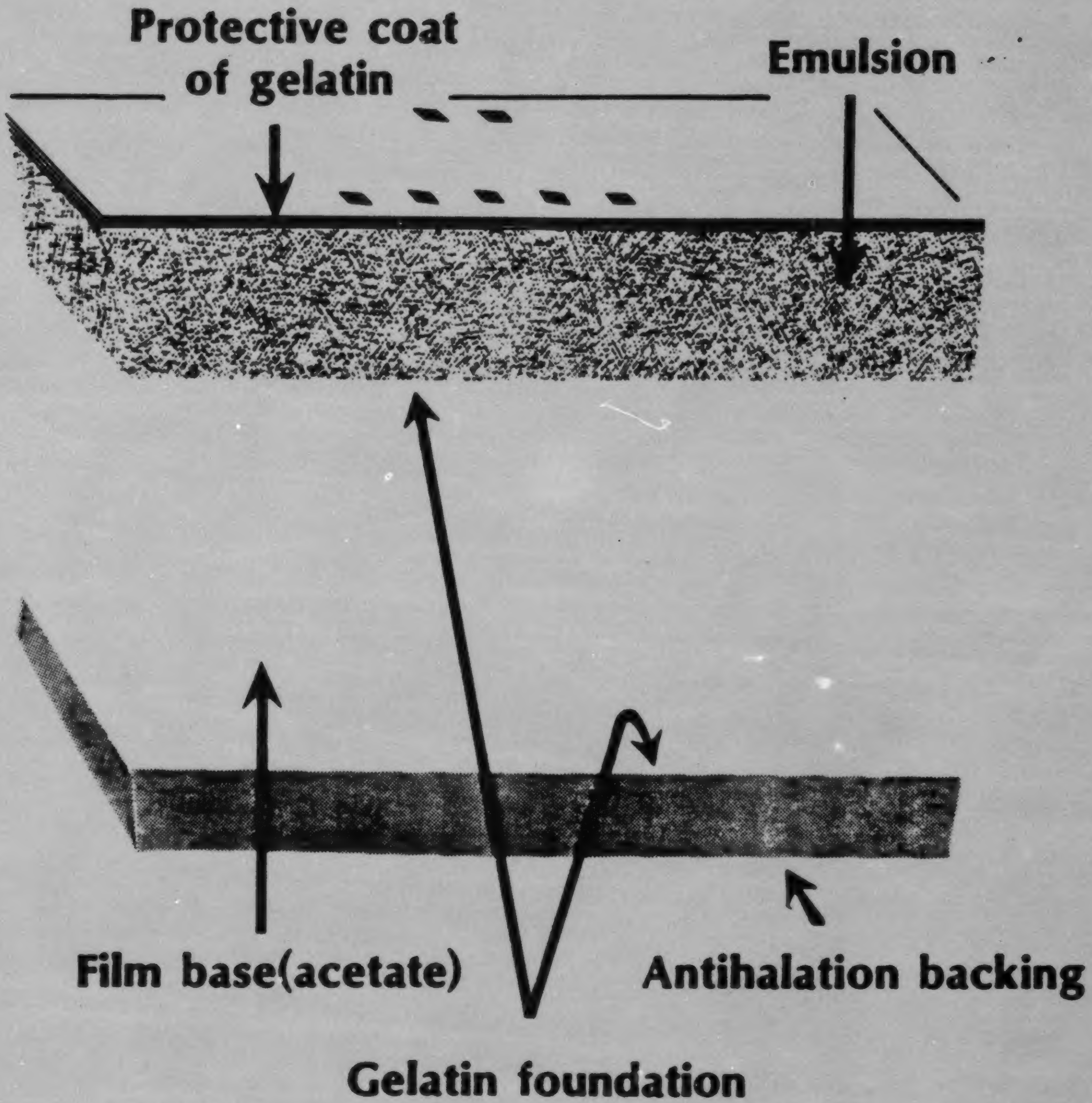
Contrast - the density range of a negative, print or slide; the brightness range of a subject or the scene lighting.

Negative - the developed film that contains a reversed image of the original object or scene.

Positive - an image with the same object or scene relationship as the original object or scene.

Tone - the degree of lightness or darkness in an area of a picture.

PHOTOGRAPHIC FILM
(ENLARGED)


Protective coat of gelatin
Emulsion
Film base(acetate)
Antihalation backing
Gelatin foundation

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THE MAJOR TYPES OF BLACK AND WHITE FILM AND THEIR CHARACTERISTICS

Name	Speed	Chacs.	End Product
Panatomic-X	ASA 32	fine grain, high quality, sharp pictures, good contrast	B&W prints
Plus-X Pan	ASA 125	General work in good light, conditions, fine-grained gives sharp pics.	B&W prints
Tri-X Pan	ASA 400	Can be used in poor light, conditions, coarse-grained	B&W prints

Demonstration #1

Objective:

To show students the difference in contrast as shown by enlargements of different pictures made of the same object made with different speeds.

Materials:

1. Enlargements of Panatomic-X pictures.
2. Enlargements of Plus-X Pan pictures.
3. Enlargements of Tri-X Pan pictures.

Procedure:

Have the students examine each of the pictures made with each type of film. Discuss the pictures and the qualities of each.

Principle:

The faster films produce more contrast. The contrast of a picture is the elimination of the grays in the pictures. Fewer shades of gray are present because fewer clumps of light-sensitive materials are present. Fewer tones are present in high speed film and more tones are present in slower speed film.

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Demonstration #2

Objective:

To show students what happens to the clarity of pictures made with the three different types of film when they are enlarged. Students should see large dots on the enlargements.

Materials:

1. Enlargement of Panatonic-X film.
2. Enlargement of Plus-X Pan film.
3. Enlargement of Tri-X Pan film.

Procedure:

Have the students examine each picture made with each type of film. Discuss the pictures and the qualities of each.

Principle:

The Tri-X Pan film will have large black dots when enlarged. Panatomic-X and Plus-X Pan are fine grain films and when they are enlarged do not show large dots.

Student Activity #1

Objective:

You will take pictures using each of the three types of black and white film. Each picture will be enlarged so the students will better see the characteristics of each type of film. Students will develop the film in a later class.

Materials:

1 - 35mm SLR Camera

1 - Roll of Panatomic-X film

1 - Roll of Plus-X Pan film

1 - Roll of Tri-X Pan film

TEST 1

Match the following terms to their definitions:

1. ___ Silver grains combined with a halogen element.

2. ___ A length of protective film at the beginning of a roll of film.

3. ___ The degree of lightness or darkness in an area of a picture.

4. ___ A light-sensitive material made of grains of silver halides suspended in gelatin and coated onto an acetate strip.

5. ___ The number giving the speed of its film.

6. ___ The density range of a negative, print, or slide; the brightness range of a subject or the scene lighting.

7. ___ A thin coating of light-sensitive material, usually a silver halide in gelatin in which the image is formed on film.

8. ___ The plastic base of film which carries the emulsion.

9. ___ The developed film that contains a reversed image of the original object or scene.

10.___ The sand-like or granular appearance of a negative, print or slide resulting from the clumping of silver grains during development of the film.

A. ASA

B. Contrast

C. Film

D. Film leader

E. Emulsion

F. Acetate

G. Tone

H. Silver halides

I. Graininess

J. Negative

TEST 2

Match the film name to the proper characteristics.

1. Speed - ASA 400
   Good Contrast
   Coarse Grain ____

2. Speed - ASA 32
   High Contrast
   Fine Grain ____

3. Speed - ASA 125
   Good Contrast
   Fine Grain ____

A. Panatomic-X

B. Tri-X Pan

C. Plus-X Pan

ANSWERS TO TEST 1

1. H
2. D
3. G
4. C
5. A
6. B
7. E
8. F
9. J
10. I

ANSWERS TO TEST 2

1. B
2. A
3. C

REFERENCES/RESOURCES

I. References

A. Gerace, Philip G, and Mangiane, Stephen S., *Communication: Photography,* Met Series, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976.

B. Muse, Ken., *Photo One,* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972.

II. Resources

A. Information Sheets.

B. Activity Sheets.

C. Demonstrations.

D. Transparency Masters.

EQUIPMENT/SUPPLIES

I. Equipment

- 2 - 35mm SLR cameras
- 2 - Electronic flashes
- 2 - Tripods
- 2 - Light meters
- 2 - Shutter release cables

II. Supplies

- 6 - rolls of Panatomic-X film.
- 6 - rolls of Plus-X Pan film.
- 6 - rolls of Tri-X Pan film.

DEVELOPING BLACK AND WHITE FILM

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the process used to develop black and white film to include the chemicals which are used; processing methods; and developing procedures.

CONTENT OUTLINE:

1. Chemicals Involved
   a. Developer
   b. Stop Bath
   c. Fixer
2. Processing Methods
   a. Tank
   b. Tray
   c. Automated
3. Developing Procedures

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Do classroom demonstrations as required.
4. Attend classroom discussions relating to the content outline.
5. Arrange a field trip to a local film processing industry.

STUDENT ACTIVITIES:

1. Participate in lecture discussions as defined by the content outline.
2. Complete assigned lab activities as required.

OUTLINE OF CONTENT

I. Chemicals Involved

A. Developer

The emulsion side of the film is hit by the light as it enters the lens of the camera. The developer reacts chemically with the film emulsion during the processing of the exposed film. The film will range from black to white once it has been developed since different areas of the film received different amounts of light. Images that have been created on the film are the opposite of the original scene. Dark areas of the scene appear as light areas on the film. This is the reason developed film is called a negative.

B. Stop Bath

Stop bath is another chemical used to stop the chemical reaction of the developer. The stop bath is diluted acid and should be worked with carefully.

C. Fixer

Although the reaction between the developer and the film is stopped after it is placed in the stop bath, the film can still react to light because part of the emulsion on the film was not affected by the light during the first exposure. The negative will be ruined by being turned black by the emulsion being exposed to more light. The fixer is another chemical solution used to prevent the emulsion from being affected by light. The fixing solution contains chemicals that will remove the unused emulsion so that the negative will no longer be sensitive to light. The fixing solution also contains chemicals that help to harden the film which has become soft during developing. The fixer makes the negative more durable and harder to scratch.

II. Processing Methods

A. Tank method

B. Tray method

C. Automated processes

III. Developing Procedures

NOTE: Temperature of solutions and developing time are the most important factors affecting good negative processing. The best developing temperature is 68 degrees. The developer water and hypo should all be the same temperature. The temperature is important and should be carefully maintained at the same level. The warmer the developer the more rapidly it works. The temperature of the developer can be raised by handling too much.

The rate of development is controlled by time, temperature, and agitation. The effects of each are figured into film development for "predictable" results. Follow your directions carefully.

A. Half-fill a large jar or pitcher with lukewarm water. Check the temperature with a thermometer and add the proper amounts of cool or warm water until it has stabilized at 68 degrees F (20 degrees C) for at least one (1) full minute.

B. Mix the developer according to the instructions packaged with it. Pour the proper amount into the developing tank and the rest into a jar labeled Developer.

C. Mix the stop bath according to the instructions packaged with it. Pour it into a jar labeled Stop Bath.

D. Mix the fixer according to the instructions packaged with it. Pour it into a jar labeled Fixer.

E. In total darkness remove the film from the film cartridge. Detach the film and discard the paper and tape that has been around the film. Handle the film by the edges only.

F. While handling the film by its edges, roll the film into the apron or reel according to the tank instruction. Put the reel or apron into the tank, secure the lid, and start timing. Room lights may be turned on.

G. Remove any air bubbles by tapping the tank against the working surfaces. Agitate the tank by inverting it, rotating it in a circular motion or rotating the reels. Agitate for five (5) seconds at thirty (30) second intervals. When the developing time is over, pour the solution back into the developer jar.

H. Pour the stop bath solution into the tank through the opening in the top. Do not open the tank. Agitate gently for thirty (30) seconds, and then pour the liquid back into its original jar.

I. Add the fixer solution and agitate as before. At the end of the fixing time (2 to 4 minutes with Kodafix Solution, 5 to 10 minutes with Kodak Fixer), pour the solution into its jar.

J. Open the tank and inspect the film for the following defects in processing:

1. Beige spots - film improperly loaded so that it stuck together in the reel, preventing the chemicals from reaching the surface of the emulsion. Return to hypo and agitate until the affected area is transparent.

2. Pinkish tinge - insufficient agitation. This is residue from the anti-halation backing. Return to hypo and agitate until film clears. NOTES: Tri-X is difficult to clear. Fix until "pink" is as faint as possible. Kodak claims the tint will not interfere with printing and may disappear on exposure to light.

3. Overall cloudiness - contaminated, weakened, or exhausted fixer. Check strength of hypo and replace it if necessary. Return film to tank, protect against light until you can get fresh hypo and

repeat the fixing procedure.

K. Remove the tank cover, place the tank under a moderate stream of 65 to 75° F water, and let the film wash for about a half hour. To shorten washing time, rinse the film in Kodak Hypo Clearing Agent. Then you wash for 5 minutes.

L. Hang up the film with a film clip at each end. Dampen a viscous sponge, wring it out, and then gently run it along both sides of the film to remove large droplets of water. Let the film dry. Don't forget to rinse out all parts of your film tank.

M. Identify the negative envelope with your name, the subject matter, and date before inserting film. Cut negatiyes in strips: 2-1/4" x 2-1/4" frames, or five 35mm frames. Keep negatives protected in the envelope at all times except when in use.

NOTE: Each step of the developing procedure should be carefully explained and demonstrated by the instructor.

Information Sheet #1

THE BASIC CHEMICALS USED TO DEVELOP BLACK AND WHITE NEGATIVES AND THEIR PURPOSES

I. DEVELOPER

When taking pictures, light is allowed to hit the emulsion of the film inside the camera. While processing this exposed film, the developer causes a chemical reaction to occur between itself and the film emulsion. Where the strongest and largest amount of light has hit the film, the chemical reaction is the greatest and this causes the film emulsion to turn black. The film will range from black to white once it has been developed since different areas of the film received different amounts of light. The image which has now been created on the film is just the opposite of the original scene (the dark areas of the actual scene are the lightest areas on the film), and this is why we call the developed film a negative.

II. STOP BATH

To stop the chemical reaction of the developer, another chemical is necessary; namely, a stop bath. This stop bath consists of a diluted acid and should, therefore, be handled with care. (It may irritate sensitive skin, etc.)

III. FIXER

Although the reaction between the developer and the film is stopped once it has been placed in a stop bath, the film is still sensitive to light because part of the emulsion on the film was not affected by the light during the first exposure. If this emulsion is exposed to more light now, it will turn black and ruin the negative. To prevent this, another chemical solution is needed: the fixer. The fixing solution contains chemicals that help to harden the film which has become very soft during the development process. This makes the negative more durable and harder to scratch.

Information Sheet #2

I. Terms and Definitions

Agitation - keeping the developer, stop bath or fixer in gentle motion while processing film or paper. Agitation helps to speed and ensure even development and prevent spotting or staining.

Clearing agent - a chemical that neutralizes hypo on film or paper, reducing washing time and helping to provide a more stable image.

Darkroom - a light tight area used for processing films and for printing and processing papers; also for loading and unloading film holders and some cameras.

Densitometer - an instrument for measuring the density of an area in a negative or print.

Density - the blackness of an area in a negative or print which determines the amount of light that will pass through it or reflect from it.

Developer - a solution used to turn the latent image into a visible image on exposed film or photographic paper.

Developing tank - a light tight container used for processing film.

Emulsion - the thin coating of gelatin containing silver halides on photographic film or paper.

Etching - scraping black spots off a print or negative with a special knife.

Film leader - a length of protective film at the beginning of a roll of unexposed or processed film.

Fixing bath - a solution that removes any light sensitive salt not acted upon by light or developer leaving a black and white negative or print unalterable by further action of light.

Flat - too low in contrast the range in density in a negative or print is too short.

Flat lighting - lighting that produces very little contrast or modeling on the subject with a minimum of shadows.

Fogging - Darkening or discoloring of a negative or print or lightening or discoloring of a slide caused by (1) exposure to non-image-forming light to which the photographic material is sensitive, (2) too much handling in air during development, (3) overdevelopment, (4) outdated film or paper, or (5) storage of film or paper in a hot, humid place.

Forced development - increasing the development time of a film to increase its effective speed (ASA) for low-light situations; push processing.

Graininess - the sand-like or granular appearance of a negative, print or slide resulting from the clumping of silver grains during development of the film.

High contrast - a wide range of density in a print or negative.

Highlights - the brightest areas of a subject and the corresponding areas in a negative.

Hypo - the name for a fixing bath made from sodium thiosulfate, other chemicals and water.

Latent image - the invisible image left by the action of light on photographic film or paper. When processed, the latent image becomes the visible image either in reversed tones, as in a negative, or in positive tones, as in a color transparency.

Negative - the developed film that contains a reversed-tone image of the original scene.

Positive - the opposite of a negative, an image with the same tonal relationships as those in the original scene.

Reticulation - cracking or distorting of the emulsion during processing, usually caused by wide temperature or chemical-acting differences between the solutions.

Retouching - altering a print or negative after development by use of dyes or pencils to alter tones of highlights, shadows, and other details, or to remove blemishes.

Safelight - an enclosed darkroom lamp fitted with a filter to screen out light rays to which film and paper are sensitive.

Stain - Discolored ares on film or paper, usually caused by contaminated developing solution or by insufficient fixing, washing, or agitation.

Stop bath - an acid rinse, usually a weak solution of acetic acid, used as a second step when developing black and white film or paper; it stops development and makes the hypo last longer.

Thin negative - a negative that is underexposed or underdeveloped (or both); a thin negative appears less dense than a normal negative.

Underexposed - a condition in which too little light reaches the film, producing a thin negative.

Replenisher - a chemical solution that increases the life of other chemical solutions when it is added to them.

II. Problems Encountered with Negative Development

Streaky negatives - due to uneven development. Not all of the film was in contact with the developer during development time or there was not enough solution.

Rows of regularly spaced marks - if they occur inside the picture area of the negative, it's because the film wasn't properly seated in the apron or because the wrong apron was used.

Black streaks - a sign that light reached the film while the film was being loaded or unloaded into or out of the camera. If all the streaks are on the same side, the top of the developing tank may have loosened during processing.

Overall grayness - caused by light sneaking into the darkroom during the time film was being loaded into the developing tank.

Thin transparent negatives - if there are no really dark black areas in the entire negative, it usually means that your developer was too cold, you cut short the developing time, or the negative was over exposed.

Dense, heavy negatives - the developer was too warm, the film developed too long, or the negative overexposed.

DEVELOPING ROLL FILM

by Ronald Bass

1. Load film into stainless steel tank. This must be done in total darkness. Be sure the lid is on tightly before turning on room lights or taking tank out into a lighted area. When agitating, be sure to hold the lid on tightly to keep it from coming off accidentally--exposing your film.

2. Cool chemicals. Optimum developing temperature is 68 degrees. Developer, water, and hypo should all be the same temperature. Temperature is important and should be carefully maintained at the same level, for the warmer the developer the more rapidly it works. You can inadvertently raise the temperature of the developer by handling the can too much. The warmth of your hands makes a difference, so agitate the tank, then set it down until it is time to agitate again.

3. The rate of development is controlled by time, temperature and agitation. The effects of each are figured into film development for "predictable" results. Follow your directions carefully.

Set the timer for proper developing time. This is varied for different films. Check the film data sheet and other published information for proper time. Do not overdevelop film.

4. When the developer is determined, pour a measured eight ounces into the tank as quickly as possible, being careful not to cover the air escape opening. Trapped air can fool you into thinking the tank is full. Use the full eight ounces.

5. Start the timer.

6. Agitate the tank constantly the first 15 seconds. Then agitate intermittently thereafter at the rate of 5 seconds every minute. More agitation than this will result in overdevelopment; less agitation will result in underdevelopment. Keep hands off the tank between agitations.

7. When development is complete, pour developer back into the bottle. Be extremely careful not to get the developer and hypo bottles mixed up.

8. Without removing the lid, and again, being careful not to block the air escape with liquid, fill the tank with running water, slosh it around to agitate, and drain the tank. Repeat. This must be done quickly because developer is still present on your film even though its action is weakened by dilution.

9. Drain the tank completely and refill it with eight ounces of photo fix (hypo). Be sure the tank is filled. You can judge by the weight and by an even chill from top to bottom. The hypo should be the same temperature as the developer--or at least not more than four degrees warmer.

10. Agitate constantly for the first 30 seconds, then intermittently at the same rate as when developing (5 seconds per minute) for a total period of 10 minutes. Hypo fixes the image permanently against further reaction to light by neutralizing the developer and dissolving all unused silver salts. It also contains a hardener to help protect the delicate emulsion against damage in further handling.

11. It is now safe to open the tank in the light. Open the tank and inspect your film for defects in processing:

A. Beige spots - film improperly loaded so that it stuck together in the reel, preventing the chemicals from reaching the surface of the emulsion. Return to hypo and agitate until the affected area is transparent.

B. Pinkish tinge - insufficient agitation. This is residue from the anti-halation backing. Return to hypo and agitate until film clears. NOTE: Tri-X is difficult to clear. Fix until "pink" is as faint as possible. Kodak claims the tint will not interfere with printing and may disappear on exposure to light.

C. Overall cloudiness - contaminated, weakened, or exhausted fixer. Have instructor check strength of hypo and replace it if necessary. Return film to tank, protect against light until you can get fresh hypo and repeat the fixing procedure.

12. After following the fixing procedure, return hypo to the bottle. Remove the lid from the tank and rinse negatives thoroughly with running water. Fill and empty tank at least five times with the reel inside.

13. Remove film from reel and treat by hand, with constant agitation in hypo clearing agent for two minutes. Hypo-clear chemically neutralizes the hypo and cuts the wash time from 30 minutes (when clearing agent is not used) to 5 minutes. Many photographers feel that the quality of the image and the grain structure is adversely affected by a long "wet time." Shortening the "wet time" improves the quality of the negative and protects the delicate emulsion against damage.

14. Drain and wash in running water for five minutes.

15. Drain and treat in photo-flo for 30 seconds. Photo-flo is a wetting agent that cuts the surface tension of water and causes excess water to run off in sheets and prevents water spots. Be cautious about the conditin of the photo-flo provided for your use. If it appears to have developed a scum or accumulated dust and dirt, do not use it. Inspect your film for dust particles that may not have been dislodged. With your fingers moistened with photo-flo, you can gently dislodge any such particles.

16. Drain carefully. It is not necessary to squeegee the film or wipe it with anything that may contain grit or dust particles. With photo-flo, your negatives will drain quickly enough. Hang to dry.

17. Remove film from drying line as soon as possible. Leaving film

for several days only invites damage from wet rolls being hung up, from atmospheric "trash," and from careless students.

18. Identify your negative envelope with your name, the subject matter, date, and course number before you insert the film. A pencil or pen writing over a negative can damage it. Cut negatives in strips: 2-1/4" x 2-1/4" frames, or five 35mm frames. Keep negatives protected in the envelope at all times except when in acutal use.

Information Sheet #3

Steps in Developing Roll Film

NOTE: Temperature of solutions and developing time are one of the most important factors affecting good negative processing. The best developing temperature is 68 degrees. The developer water and hypo should all be the same temperature. The temperature is important and should be carefully maintained at the same level. The warmer the developer the more rapidly it works. The temperature of the developer can be raised by handling it too much.

The rate of development is controlled by time, temperature, and agitation. The effects of each are figured into film development for "predictable" results. Follow your directions carefully.

A. Half-fill a large jar or pitcher with lukewarm water. Check the temperature with a thermometer and add the proper amounts of cool or warm water until it has stabilized at 68°oF (20°oC) for at least one (1) full minute.

B. Mix the developer according to the instructions packaged with it. Pour the proper amount into the developing tank and the rest into a jar labeled Developer.

C. Mix the stop bath according to the instructions packaged with it. Pour it into a jar labeled Stop Bath.

D. Mix the fixer according to the instructions pacakaged with it. Pour it into a jar labeled Fixer.

E. In total darkness remove the film from the film cartridge. Detach the film and discard the paper and tape that has been around the film. Handle the film by the edges only.

F. While handling the film by its edges, roll the film into the apron or reel according to the tank instruction. Put the rel or apron into the tank, secure the lid, and start timing. Room lights may be turned on.

G. Remove any air bubbles by tapping the tank against the working surfaces. Agitate the tank by inverting it, rotating it in a circular motion or rotating the reels. Agitate for five (5) seconds at thirty (30) second intervals. When the developing time is over pour the solution back into the developer jar.

H. Pour the stop bath solution into the tank through the opening in the top. Do not open the tank. Agitate gently for thirty (30) seconds, and then pour the liquid back into its original jar.

I. Add the fixer solution and agitate as before. At the end of the fixing time (2 to 4 minutes with Kodafix Solution, 5 to 10 minutes with Kodak Fixer), pour the solution into its jar.

J. Open the tank and inspect the film for the following defects in processing:

1. Beige spots - film improperly loaded so that it stuck together in the reel, preventing the chemicals from reaching the surface of the emulsion. Return to hypo and agitate until the affected area is transparent.

2. Pinkish tinge - insufficient agitation. This is residue from the anti-halation backing. Return to hypo and agitate until film clears. NOTE: Tri-X is difficult to clear. Fix until "pink" is as faint as possible. Kodak claims the tint will not interfere with printing and may disappear on exposure to light.

3. Overall cloudiness - contaminated, weakened, or exhausted fixer. Check strength of hypo and replace it if necessary. Return film to tank, protect against light until you can get fresh hypo and repeat the fixing procedure.

K. Remove the tank cover, place the tank under a moderate stream of 65 to 75°oF water, and let the film wash for about a half hour. To shorten washing time, rinse the film in Kodak Hypo Clearing Agent. Then you wash for 5 minutes.

L. Hang up the film with a film clip at each end. Dampen a viscous sponge, wring it ous, and then gently run it along both sides of the film to remove large droplets of water. Let the film dry. Don't forget to rise out all parts of you film tank.

M. Identify the negative envelope with your name, the subject matter, and date before inserting film. Cut negatives in strips: 2-1/4" x 2-1/4" frames, or five 35mm frames. Keep negatives protected in the envelope at all times except when in use.

Information Sheet #4

A FEW REMINDERS ON FILM PROCESSING

1. Mix the needed chemicals and have them immediately available:

    a. developer
    b. stop bath
    c. rapid fixer
    d. photo-flo

2. Load your film into the developing tank.

A) if you have access to a darkroom, film can be loaded directly into the tank. Make sure no one accidentally turns on the lights!

OR

B) if you do not have access to a darkroom, you will need a changing bag to load your film into the developing tank. Before you start, make certain everything you need is already in the bag: film canister (exposed), can opener, developing tank and lid, apron, and weight.

Use a bottle opener to remove 35mm film from the canister. If you are using Instamatic 126 film cartridges, twist them until they break open; then remove the film carefully!

3. Turn on the lights or remove the developing tank from the changing bag. Check the table (next page) for times and temperatures, and pour in the developer. Keep track of the time! Be accurate!

4. Pour out the developer and rinse the tank with water. Than add stop bath for approximately 30 seconds.

5. Pour out the stop bath (SAVE!) and add the fixer for these times:

    1-2 mins for Pan-X film
    2-4 mins for Plus-X film
    2-4 mins for Tri-X film

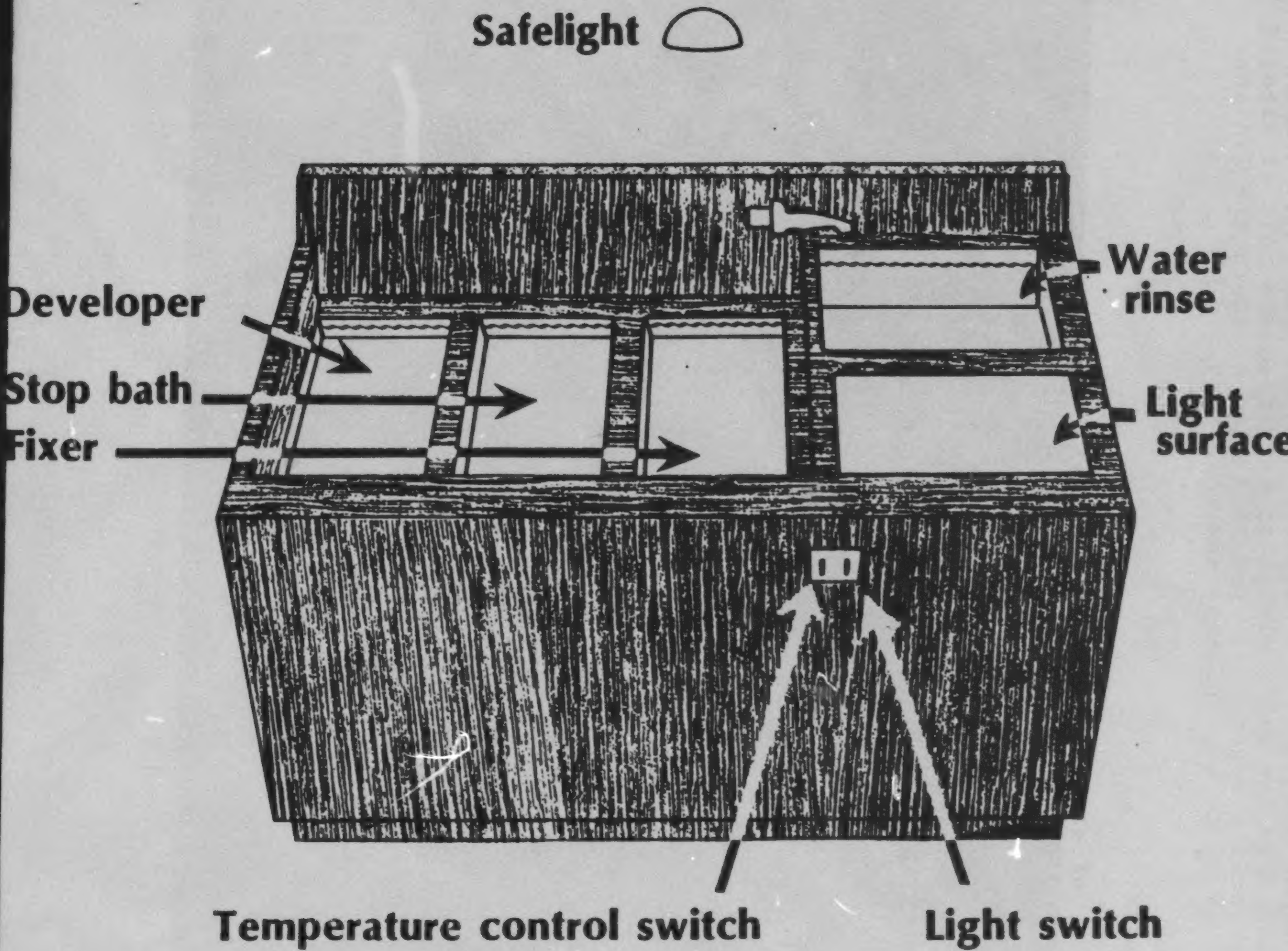
6. Pour out the fixer (SAVE!), open the tank and flush the film with water for approximately 20 minutes.

7. Dip the film in photo-flo.

8. VERY CAREFULLY! blot the film, removing excess water. Then hang the film up to dry.

TIMES AND TEMPERATURES TABLES
FOR D-76 DEVELOPER

Film	Temperature	Time
Pan-X	65	11
	68	9
	70	8
	72	7
	75	6
Plus-X	65	8
	68	7
	70	6-1/2
	72	6
	75	5
Tri-X	65	11
	68	10
	70	9-1/2
	72	9
	75	8


Safelight
Developer
Stop bath
Fixer
Water rinse
Light surface
Temperature control switch
Light switch

Student Activity #1

DEVELOPING BLACK AND WHITE FILM

Objective:

You will take the materials given and process a roll of exposed film into printable negatives. You will also evaluate the finished negatives as to any problems and solutions.

Materials:

1 - roll of exposed 35mm black and white film.

1 - processing tank

1 - darkroom thermometer

1 - darkroom graduate

2 - spring-type clothespins

4 - large jars

1 - darkroom timer

Chemicals: Kodak Developer D-76, Kodak Indicator Stop Bath, and Kodak fixer or KodaFix solution.

A stirring rod

Changing bag

UNIT TEST

Match the terms on the bottom to the correct description.

1. The ____ is a solution that removes any light sensitive salt not acted upon by light or developer leaving a black and white negative or print unalterable by further action of light.

2. A ____ is a length of protective film at the beginning of a roll of unexposed or processed film.

3. The ____ is a light tight container used for processing film.

4. ____ is a chemical that neutralizes hypo in film or paper, reducing washing time and helping to provide a more stable image.

5. ____ is a fixing bath made from sodium thiosulfate, other chemicals and water.

6. A ____ is developed film that contains a reversed-tone image of the original scene.

7. A ____ is the opposite of a negative, an image with the same tonal relationships as those in the original scene.

8. The ____ is an acid rinse, usually a weak solution of acetic acid, used as a second step when developing black and white film or paper.

9. The ____ is the solution used to turn the latent image into a visible image on exposed film or photographic paper.

10. ____ are the lightest areas of density in a print or negative.

11. ____ is the blackness of an area in a negative or print which determines the amount of light that will pass through it or reflect from it.

A. Hypo

B. Film leader

C. Positive

D. Fixing bath

E. Negative

F. Stop Bath

G. High Contrast

H. Developing Tank

I. Developer

J. Clearing Agent

K. Density

ANSWERS TO TEST

1. D
2. B
3. H
4. J
5. A
6. E
7. C
8. F
9. I
10. G
11. K

REFERENCES/RESOURCES

I. References

A. *Basic Developing, Printing, Enlarging in Black and White,* Eastman Kodak Company #AJ-2, Consumer Markets Division, Rochester, New York: 1977.

B. CBIE Project, *Industrial Education Visual Communication Revised,* Kansas Sttate Department of Education, Wichita, Kansas.

C. Gerace, Philip G., Mangione, Stephen S., *Communication: Photography,* MET Series, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976.

D. Muse, Ken, *Photo One,* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1973.

II. Resources

A. Information Sheet

B. Activity Sheets

C. Demonstrations

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EQUIPMENT/SUPPLIES

I. Equipment

  A. 6 - processing tanks

  B. 6 - darkroom thermometers

  C. 6 - darkroom graduates

  D. 24 - spring-type clothespins

  E. 8 - large jars

  F. 6 - darkroom timers

  G. 6 - stirring rods

  H. 2 - changing bags

II. Supplies

  A. Two gallons of Kodak Developer D-76

  B. Two gallons of Kodak Indicator Stop Bath

  C. Two gallons of Kodak Fixer or KodaFix solution

  D. 24 rolls of exposed Tri-X Pan film

PHOTOGRAPHIC PAPERS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of papers commonly used by the photographic communications industry to include paper bases, surfaces, texture, tint contrast grade and image tone, and surface emulsions.

CONTENT OUTLINE:

1. Paper bases (weights)

2. Paper surfaces

    a. Glossy
    b. High lustre
    c. Lustre
    d. Matte

3. Paper texture

    a. Smooth
    b. Fine grained
    c. Silk
    d. Tweed
    e. Tapestry

4. Paper tint

    a. White
    b. Warm white
    c. Cream white

5. Contrast grade and image tone

    a. Contrast grade
    b. Image tone

6. Emulsion/Coatings

TEACHER ACTIVITIES:

1. Make transparencies.

2. Present information relative to the content outline.

3. Do classroom demonstrations as required.

4. Attend classroom discussions relating to the content outline.

STUDENT ACTIVITIES:

1. Participate in classroom lecture discussions as defined by the content outline.

2. Complete lab activities as required.

OUTLINE OF CONTENT

I. Paper bases/weights

  A. Single Weight - S.W.

  B. Light Weight - L.W.

  C. Double Weight - D.W.

    1. Used in large prints

    2. Better handling characteristics

  D. Medium Weight - M.W.

    1. Preferable for enlargements

    2. Good handling characteristics

II. Paper Surfaces

  A. Glossy

    1. Best for brilliant prints.

    2. Best reproduction of fine detail.

    3. Good for album prints and pictures to be published in books and magazines.

    4. Dry glossy prints on ferrotype plates or on a ferrotype dryer to obtain the highest gloss.

    5. Do not ferrotype any Kodak RC Papers.

  B. High Lustre

    1. Sheen slightly less than glossy paper.

    2. Good for prints requiring a great deal of brilliance without ferrotyping.

  C. Lustre

    1. Has a midway sheen between Glossy and Matte.

    2. Provides an intermediate brilliance to portraits and subjects requiring moderate sparkle.

  D. Matte

    1. Subdues brilliance.

2. Used for low-key (dark-tone) or high-key (light-tone) pictures and atmospheric landscapes.

3. Used widely by portrait photographers.

III. Paper Texture

A. Smooth

1. Has no noticeable surface pattern to interfere with reproduction of fine detail.

2. Best surface for small prints.

B. Fine-Grained

1. A slightly pebbled surface.

2. Does not lose definition.

3. Good for scenic views, children's portraits and exhibition prints.

C. Silk

1. Has a clothlike texture with a high-lustre surface.

2. Good for snow and water scenes, wedding pictures, still lifes and some portraits.

D. Tweed

1. A rough and obvious texture.

2. Texture hides fine details.

3. Emphasis masses in landscapes and portraits.

4. Suitable for large artistic prints.

E. Tapestry

1. The texture resembles an artist's canvas.

2. Detail is subdued to a maximum.

3. Best for large prints.

IV. Paper Stock Tint

A. White

1. Best for cold-toned subjects (snow scenes; seascapes).

2. Good for high-key pictures where blue tones are desired.

3. Good for general use.

B. Warm White

1. Very good for general subjects when warmth is desired.

2. The tint is midway between white and cream white.

C. Cream White

1. A good choice for general subjects.

2. Well-suited to subjects photographed by daylight or artificial light.

V. Contrast Grade and Image Tone

A. Contrast Grade

1. No. 0 - for negatives with very high contrast.

2. No. 1 - for negatives with high contrast.

3. No. 2 - for negatives with normal contrast.

4. No. 3 - for negatives with less than normal contrast.

5. No. 4 - for negatives with low contrast.

6. No. 5 - for negatives with very low contrast.

B. Image Tone

1. Warm tone tends toward brown.

2. Cold tone tends toward blue.

3. Designations for Kodak papers are:

a. Blue-black

b. Neutral-black

c. Warm-black

d. Brown-black

VI. Emulsions/Coatings

A. P.O.P. - printing-out paper

1. For proofing

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a. Used by portrait photographers.

B. D.O.P. - developing-out paper

1. Silver chloride

a. Contact printing

b. Slowest or least sensitive to light

2. Silver bromide

a. Projection/enlarging printing

b. Faster or more sensitive to light

3. Chlorobromide paper

a. Suitable for fast contact printing or slow projection printing

b. Chemical - mixter of silver bromide and silver chloride

4. Resin coated (Polycontrast Rapid RC)

a. Suitable for general photographic purposes

b. Short processing and drying times due to the water resistance of the resin coating

C. Resin Coating

1. Characteristic of Kodak RC Papers

2. Helps prevent processing chemicals from printing the paper base which reduces fixing, washing, and drying times.

3. It eliminates the need for ferrotyping.

Information Sheet #1

I. Paper bases

    A. Single Weight - S.W.

    B. Light Weight - L.W.

    C. Double Weight - D.W.

        1. Used in large prints

        2. Better handling characteristics

    D. Medium Weight - M.W.

        1. Preferable for enlargements

        2. Good handling characteristics

II. Surfaces

    A. Glossy

        1. Best for brilliant prints.

        2. Best reproduction of fine detail.

        3. Good for album prints and pictures to be published in books and magazines.

        4. Dry glossy prints on ferrotype plates or on a ferrotype dryer to obtain the highest gloss.

        5. Do not ferrotype any Kodak RC papers.

    B. High Lustre

        1. Sheen slightly less than glossy paper.

        2. Good for prints requiring a great deal of brilliance without ferrotyping.

    C. Lustre

        1. Has a midway sheen between Glossy and Matte.

        2. Provides an intermediate brilliance to portraits and subjects requiring moderate sparkle.

    D. Matte

        1. Subdues brilliance.

2. Used for low-key (dark-tone) or high-key (light-tone) pictures and atmospheric landscapes.

3. Used widely by portrait photographers.

III. Texture

A. Smooth

1. Has no noticeable surface pattern to interfere with reproduction of fine detail.

2. Best surface for small parts.

B. Fine-Grained

1. A slightly pebbled surface.

2. Does not lose definition.

3. Good for scenic views, children's portraits and exhibition prints.

C. Silk

1. Has a clothlike texture with a high-lustre surface.

2. Good for snow and water scenes, wedding pictures, still lifes and some portraits.

D. Tweed

1. A rough and obvious texture.

2. Texture hides fine details.

3. Emphasizes masses in landscapes and portraits.

4. Suitable for large artistic prints.

E. Tapestry

1. The texture resembles an artist's canvas.

2. Detail is subdued to a maximum.

3. Best for large prints.

IV. Stock Tint

A. White

1. Best for cold-toned subjects (snow scenes; seascapes).

2. Good for high-key pictures where blue tones are desired.

3. Good for general use.

B. Warm White

1. Very good for general subjects when warmth is desired.

2. The tint is midway between white and cream white.

C. Cream White

1. A good choice for general subjects.

2. Well-suited to subjects photographed by daylight or artificial light.

V. Contrast Grade

A. No. 0 - for negatives with very high contrast.

B. No. 1 - for negatives with high contrast.

C. No. 2 - for negatives with normal contrast.

D. No. 3 - for negatives with less than normal contrast.

E. No. 4 - for negatives with low contrast.

F. No. 5 - for negatives with very low contrast.

VI. Image Tone

A. Warm tone tends toward brown.

B. Cold tone tends toward blue.

C. Designations for Kodak papers are:

1. Blue-black

2. Neutral-black

3. Warm-black

4. Brown-black

VII. Resin Coating

A. Characteristic of Kodak RC Papers

B. Helps prevent processing chemicals from printing the paper base which reduces fixing, washing and drying times.

C. It eliminates the need for ferrotyping.

Terms and Definitions:

Photographic characteristics - These describe the contrast grade and speed of photographic paper.

Physical characteristics - These describe the image tone, surface sheen and texture, stock tint, coating and weight.

Contrast Grade - A number telling the amount of contrast that can be expected with that photographic paper. The contrast grade numbers range from 0 through 5 with 0 for high contrast negatives and 5 for very low contrast negatives. Example: To produce normal contrast in prints, use low-contrast paper with high-contrast negatives and high-contrast paper with low-contrast negatives.

Contrast - The difference between the light and dark areas of a negative, print or slide.

Speed - The sensitivity of paper to light and is less than that of film.

Image tone - The color of the character or image in the finished print.

Surface sheen - The characterstic of paper which determines the maximum blackness the paper can produce.

Texture - The roughness of the paper which determines how the paper reproduces the fine details from a negative. The smoother the texture the finer the detail that can be reproduced.

Stock tint - The color of the photographic paper.

Weight - The thickness of the photographic paper.

Student Activity #1

Description: Students should analyze the different qualities of the photographic papers by examining examples of each type.

Teaching Procedures: The teacher should use the same negative when preparing these examples, so that stronger comparisons and contrasts can be drawn between the papers.

UNIT TEST

Match the terms with the description which best describes the term. Place the letter of your answer in the blank before each statement.

____ 1. ____ is the difference between the light and dark areas of a negative, print or slide.

____ 2. ____ is the color of the character or image in the finished print.

____ 3. The thickness of photographic paper is its ____.

____ 4. The ____ is the color of the photographic paper.

____ 5. ____ is the roughness of the paper which determines how the paper reproduces the fine details from a negative.

____ 6. The ____ of the paper is its sensitivity to light.

____ 7. ____ is the characteristic of photographic paper which determines the maximum blackness a paper can produce.

____ 8. The ____ is the number telling the amount of contrast that can be expected with that paper.

A. Image Tone

B. Texture

C. Weight

D. Contrast

E. Stock Tint

F. Surface sheen

G. Speed

H. Contrast grade

Match the photographic paper characteristic to its description by placing the letter in the blank by the description.

____ 1. ____ is the paper base that is preferred for enlargements and has good handling characterstics.

____ 2. The ____ texture is clothlike and good for snow and water scenes.

____ 3. The ____ surface paper is best for brilliant prints and produces fine detail best.

____ 4. The ____ contrast grade paper is best for very high contrast negatives.

____ 5. ____ contrast paper is best for very low contrast negatives.

____ 6. A ____ texture paper has a rough texture and usually hides fine details.

____ 7. A ____ paper base is the photographic paper used for large prints.

____ 8. A ____ surface paper subdues brilliance and is used for low-key or high-key pictures.

A. Silk
B. Tweed
C. Glossy
D. Matte
E. No. 0
F. No. 5
G. Double
H. Medium

ANSWERS TO TEST

1. D
2. A
3. C
4. E
5. B
6. G
7. F
8. H

PAPER CHARACTERISTICS

1. H
2. A
3. C
4. E
5. F
6. B
7. G
8. D

REFERENCES/RESOURCES

I. References

A. Basic Developing, Printing, Enlarging in Black and White; Eastman Kodak Company #AJ-2, Consumer Markets Division, Rochester, New York; 1977.

B. CBIE Project, Industrial Education Visual Communication Revised, Kansas State Department of Education, Wichita, Kansas.

II. Resources

A. Information Sheets

B. Activity Sheets

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PRINTING FROM NEGATIVES

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the procedures involved with printing from a negative to include papers used; steps in making a proof sheet; and the effects of temperature and time on the printing projects.

CONTENT OUTLINE:

1. Temperature and time
2. Photographic papers
3. Proof sheets

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Do classroom demonstrations as required.
4. Attend classroom discussions relating to the content outline.

STUDENT ACTIVITIES:

1. Participate in classroom lecture discussions as defined by the content outline.
2. Complete lab activities as required.

OUTLINE OF CONTENT

I. Temperature, time and agitation

A. Temperature of solutions and developing time are the most important factors affecting good contact prints and should be closely monitored.

B. The best temperature for chemicals used in contact printing is 68 degrees F.

C. Developer, water, and hypo should all be the same temperature.

D. The warmer the solutions, the more rapidly they work.

E. Solution temperatures can be raised by handling them too much.

II. Photographic papers

A. Comes in a variety of sizes, weights, surfaces, tints, speeds, textures, and contrast grades.

B. Contact printing paper is less sensitive to light than enlarging paper and requires longer exposure time to make a photograph.

C. Paper comes in contrast grades from No. 2 through No. 6.

D. No. 2 contrast paper works best for contact printing.

E. Photographic paper is sensitive to white light and should be handled in a safelight.

F. The sensitive side of the paper is called the emulsion side of the paper.

G. The emulsion side of the paper is smoother to the touch, more shiny than the back, and tends to curl inward.

III. Steps in making a proof sheet

A. Half-fill a large jar or pitcher with lukewarm water. Check the temperature with the thermometer, and then add sufficiently cool or warm water until you have it stabilized at 68 degrees F for at least 1 full minute.

B. Mix the developer according to the instructions packaged with it. Pour it into a tray labeled Developer to a depth of about 1/2 inch and then put the rest into a labeled jar.

C. Mix the stop bath according to the instructions; pour about 1/2 inch into a tray labeled Stop Bath and the rest into a labeled jar.

D. Mix the fixer according to the instructions, pour about 1/2 inch into a tray labeled Fixer, and then put the rest into a labeled jar.

E. Arrange the trays in front of you so that, from left to right, you have developer, stop bath, and fixer. Then rinse your hands well and dry them thoroughly. Turn off all lights except the safelight. The safelight should be placed at least 4 feet from your work.

F. Remove one sheet of photographic paper and close the package so light can not get in. Place the negative so the dull side faces the shiny side of the paper. The negatives should be near the light source. Cover with the glass.

G. If a print frame is being used with a 7-watt bulb, hang the bare bulb 2 feet above the frame and turn it on for about 10 seconds. Getting the correct exposure time may require experimentation.

H. If an enlarger is used, place the empty negative carrier in the enlarger and set the lens at F/11. the enlarger should be adjusted so the light covers an area a little larger than the paper. Expose for about 8 seconds. You may have to experiment to get the correct exposure time.

I. Remove the paper from the printing device with your left hand (do not get your right hand wet with developer) and slide the paper into the developer. Make sure shiny side is up. Rock the tray gently for 1-1/2 minutes by tipping up on one end and then the other end.

J. Remove the paper from the developer with your left hand. Let the paper drain for one or two seconds and slide the paper into the stop bath (center tray). Using the same method of agitation as in step I, agitate the tray for 5 to 10 seconds.

K. Remove the paper from the stop bath with your right hand and place the paper into the fixer. Agitate the prints frequently for 2 minutes and keep the prints separate from other prints in the fixing tray. After the prints have been in the fixer for 25-30 seconds, the lights can be turned on.

L. If most of the pictures on the proof sheet seem to be too light, make another proof sheet and double the exposure time used on the first. Cut the exposure time in half if most of the pictures seem too dark. You should keep notes on the exposure time and the results.

M. Wash the print for 4 minutes at 65 to 70 degrees F in the fourth tray. Agitate the print frequently while it is washing while using running water.

N. Sponge or squeegee the surface water from both sides of the print and place it into a flat surface to dry at room temperature.

I. Temperature, time and agitation

A. Temperature of solutions and developing time are the most important factors affecting good contact prints and should be maintained at all levels.

B. The best temperature for chemicals used in contact printing is 68 degrees F.

C. Developer, water, and hypo should all be the same temperature.

D. The warmer the solutions, the more rapidly they work.

E. Solution temperatures can be raised by handling them too much.

II. Photographic papers

A. Comes in variety of sizes, weights, surfaces, tints, speeds, textures, and contrast grades.

B. Contact printing paper less sensitive to light than enlarging paper and requires longer exposure time to make a photograph.

C. Paper comes in contrast grades from No. 2 through No. 6.

D. No. 2 contrast paper works best for contact printing.

E. Photographic paper is sensitive to white light and should be handled in a safelight.

F. The sensitive side of the paper is called the emulsion side of the paper.

G. The emulsion side of the paper is smoother to the touch, more shiny than the back, and tends to curl inward.

III. Steps in making a proof sheet

A. Half-fill a large jar or pitcher with lukewarm water. Check the temperature with the thermometer, and then add sufficient cool or warm water until you have it stabilized at 68 degrees F for at least 1 full minute.

B. Mix the developer according to the instructions packaged with it. Pour it into a tray labeledDDeveloper to a depth of about 1/2 inch and then put the rest into a labeled jar.

C. Mix the stop bath according to the instructions; pour about

1/2 inch into a tray labeled Stop Bath and the rest into a labeled jar.

D. Mix the fixer according to the instructions, pour about 1/2 inch into a tray labeled Fixer, and then put the rest into a labeled jar.

E. Arrange the trays in front of you so that, from left to right, you have developer, stop bath, and fixer. Then rinse your hands well and dry them thoroughly. Turn off all lights except the safelight. The safelight should be placed at least 4 feet from your work.

F. Remove one sheet of photographic paper and close the package so light can not get in. Place the negative so the dull side faces the shiny side of the paper. The negatives should be near the light source. Cover with the glass.

G. If a print frame is being used with a 7-watt bulb, hand the bare bulb 2 feet above the frame and turn it on for about 10 seconds. Getting the correct exposure time may require experimentation.

H. If an enlarger is used, place the empty negative carrier in the enlarger and set the lens at F/11. The enlarger should be adjusted so the light covers an area a little larger than the paper. Expose for about 8 seconds. You may have to experiment to get the correct exposure time.

I. Remove the paper from the printing device with your left hand (do not get your right hand wet with developer) and slide the paper into the developer. Make sure shiny side is up. Rock the tray gently for 1-1/2 minutes by tipping up on one end and then the other end.

J. Remove the paper from the developer with your left hand. Let the paper drain for one or two seconds and slide the paper into the stop bath (center tray). Using the same method of agitation as in step I, agitate the tray for 5 to 10 seconds.

K. Remove the paper from the stop bath with your right hand and place the paper into the fixer. Agitate the prints frequently for 2 minutes and keep the prints separate from other prints in the fixing tray. After the prints have been in the fixer for 25-30 seconds, the lights can be turned on.

L. If most of the pictures on the proof sheet seem to be too light, make another proof sheet and double the exposure time used on the first. Cut the exposure time in half if most of the pictures seem too dark. You should keep notes on the exposure time and the results.

M. Wash the print for 4 minutes at 65 to 70 degrees F in the fourth tray. Agitate the print frequently while it is washing while using running water.

N. Sponge or squeegee the surface water from both sides of the print and place it onto a flat surface to dry at room temperature.

Information Sheet #2

Terms and Definitions:

Safelight - The working light source for making photographic prints.

Contact printing frame - A device that holds the negative and photographic paper together during exposure. The paper is exposed by light from an external light source.

Contact print - A photographic print made by placing the negative and the printing paper in direct contact for exposure. Contact prints are the same size as the negative.

Contrast - The difference between the shades of black and white in a photograph. A high contrast photograph (one with strong blacks, brilliant whites, and only a few mid-tones) is called "contrasty." A low contrast photograph (one with weak, grayish blacks and many mid-tones) is called "flat."

Contrast grade - A number system used to describe the contrat characteristics that are built into photographic enlarging papers. Contrast grades range from 0 to 6. "Normal" paper is number 2. Papers with a number lower than 2 have a low contrast, and are used to make normal contrast prints from high contrast negatives. Papers with numbers higher than 2 have high contrast, and are used to make normal contrast prints from low contrast negatives.

Paper negative - A negative image that is made on paper instead of film.

Photogram - A shadow image made by laying objects on top of photographic paper and exposing it through the objects.

Print - A positive image on photographic paper.

Process - To develop film or paper.

Push - To develop film longer than normal. Pushing effectively increases the speed of film. It also increases the size of the grain and the contrast.

RC Paper - Printing paper with a plastic coating under the emulsion.

Soft - An image that is not sharp. A low contrast image.

Test Strip - A strip of photographic paper on which trial exposures of varying lengths are made to determine which is the correct exposure.

Variable-contrast paper - A type of photographic printing paper. The contrast of variable-contrast papers can be changed with filters that are calibrated in contrast grades.

Emulsion side - The side of the film coated with emulsion. (In contact printing and enlarging, the emulsion side--dull side--of the film should face the emulsion side--shiny side--of the photographic paper).

Ferrotype plate - A chromium-plated or black enameled sheet of steel, or mirror-plated glass, used to dry prints to a high-gloss finish; the procedure is sometimes defined as "glazing."

Fogging - Darkening or discoloring of a negative or print or lightening or discoloring of a slide caused by (1) exposure to non-image-forming light to which the photographic material is sensitive, (2) too much handling in air during development, (3) overdevelopment, (4) outdated film or paper, or (5) storage of film or paper in a hot, humid place.

Overexposure - A washed out print caused by being exposed to too much light.

Positive - The opposite of a negative; a finished print.

Printing box - A device used for contact printing that consists of a lighttight box with a source of light and a frame to position the negative against the photographic paper in front of the light.

Printing frame - A device used for contact printing that holds a negative against the photographic paper. The paper is exposed by light from an external light source.

Cropping - A portion of the negative area is omitted when printing and enlarging.

Retouching - Altering a print or negative after development by use of dyes or pencils to alter tones of highlights, shadows and other details, or to remove blemishes.

Spotting - Retouching a processed print with a pencil or brush (with water colors or dyes) to eliminate spots left by dust on the negative.

Stain - Discolored areas on film or paper, usually caused by contaminated developing solutions or by insufficient fixing, washing or agitation.

Tint - Shades of white in a finished print, controlled by the color of the paper, varying from white to buff.

Tone - The degree of lightness or darkness in any given area of a print.

Toning - Intensifying or changing the tone of a photographic print after processing.

Vignetting - Printing the central area of a picture while shading the edge areas gradually into white.

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Diffusing - Softening detail in a print with a diffusion disk or other material that scatters light.

Diffusion disk - A flat glass with a pattern of lines or concentric rings that breass up and scatters light from an enlarger lens and softens detail in a print.

Student Activity #1

Objective:

You will take the materials and the negatives you previously developed and complete the following: (1) make a proof sheet from the negatives, (2) evaluate all prints on the proof sheet and discuss ways to improve them, and (3) make a new print of each negative following the suggestions that were made.

Materials:

1 - printing frame and a 7-watt light bulb.

4 - trays, 8 x 10 inches in size (Kodak Duraflex)

1 - stirring rod

1 - darkroom graduate

4 - large jars

Photographic paper (Kodak Polycontrast Rapid RC Paper, 8 x 10 inches)

A safelight (Brownie Darkroom Lamp Kit or Kodak Darkroom Lamp with a Kodak Safelight filter OC)

Chemicals: (1) Kodak Dektol Developer,
(2) Kodak Indicator Stop Bath
(3) Kodak Fixer or Kodafix Solution.

Darkroom timer

Rubber squeegee

Procedure:

A. Half-fill a large jar or pitcher with lukewarm water. Check the temperature with the thermometer, and then add sufficient cool or warm water until you have it stabilized at 68 degrees F for at least 1 full minute.

B. Mix the developer according to the instructions packaged with it. Pour it into a tray labeled Developer to a depth of about 1/2 inch and then put the rest into a labeled jar.

C. Mix the stop bath according to the instructions; pour about 1/2 inch into a tray labeled Stop Bath and the rest into a labeled jar.

D. Mix the fixer according to the instructions, pour about 1/2 inch into a tray labeled Fixer, and then put the rest into a labeled jar.

E. Arrange the trays in front of you so that, from left to right, you have developer, stop bath and fixer. Then rinse your hands well and dry them thoroughly. Turn off all lights except the safelight. The safelight should be placed at least 4 feet from your work.

F. Remove one sheet of photographic paper and close the package so light can not get in. Place the negative so the dull side faces the shiny side of the paper. The negatives should be near the light source. Cover with the glass.

G. If a print frame is being used with a 7-watt bulb, hang the bare bulb 2 feet above the frame and turn it on for about 10 seconds. Getting the correct exposure time may require experimentation.

H. If an enlarger is used, place the empty negative carrier in the enlarger and set the lens at F/11. The enlarger should be adjusted so the light covers an area a little larger than the paper. Expose for about 8 seconds. You may have to experiment to get the correct exposure time.

I. Remove the paper from the printing device with your left hand (do not get your right hand wet with developer) and slide the paper into the developer. Make sure shiny side is up. Rock the tray gently for 1-1/2 minutes by tipping up one end and then the other end.

J. Remove the paper from the developer with your left hand. Let the paper drain for one or two seconds and slide the paper into the stop bath (center tray). Using the same method of agitation as in step I, agitate the tray for 5 to 10 seconds.

K. Remove the paper from the stop bath with your right hand and place the paper into the fixer. Agitate the prints frequently for 2 minutes and keep the prints separate from other prints in the fixing tray. After the prints have been in the fixer for 25-30 seconds, the lights can be turned on.

L. If most of the pictures on the proof sheet seem to be too light, make another proof sheet and double the exposure time used on the first. Cut the exposure time in half if most of the pictues seem too dark. You should keep notes on the exposure time and the results.

M. Wash the print for 4 minutes at 65 to 70 degrees F in the fourth tray. Agitate the print frequently while it is washing while using running water.

N. Sponge or squeegee the surface water from both sides of the print and place in onto a flat surface to dry at room temperature.

UNIT TEST

Match the terms from photo printing which best describes the term. Place the letter of your answer in the blank before each statement.

____ 1. A ____ is a photographic print made by placing the negative and printing paper indirect contact for exposure.

____ 2. A ____ is a working light source for making photographic prints.

____ 3. A ____ is a positive image on photographic paper.

____ 4. ____ is the degree of lightness or darkness in any given area of a print.

____ 5. The ____ of a print is the shade of white in the finished print and is controlled by the color of the paper.

____ 6. A ____ is a device used for contact printing that holds the negative against the photographic paper.

____ 7. To ____ film development means developing longer than normal and increases the speed of the film.

____ 8. ____ paper can have its contrast changed by using filters calibrated in contrast grades.

____ 9. ____ is printing paper with a plastic coating under the emulsion.

____10. A ____ is a strip of photographic paper on which trial exposures of different lengths are made to determine the correct exposures.

ANSWERS TO TEST

1. H
2. A
3. J
4. D
5. I
6. B
7. G
8. F
9. C
10. E

ENLARGEMENTS

UNIT OBJECTIVES:

Upon completion of this unit, the students will demonstrate basic knowledge of the procedures involved with making enlargements, to include the methods used; enlargement procedures and printing; and enlarging operations.

CONTENT OUTLINE:

1. Methods of exposure
    a. Contact Printing
    b. Enlargement
2. Enlarging Procedures
3. Printing and Enlarging Techniques
    a. Cropping
    b. Vignetting
    c. Dodging
    d. Diffusing
    e. Burning-in

TEACHER ACTIVITIES:

1. Make transparencies.
2. Present information relative to the content outline.
3. Do classroom demonstrations as required.
4. Attend classroom discussions relating to the content outline.
5. Arrange a field trip to a local photographic processor using enlargement techniques.

STUDENT ACTIVITIES:

1. Participate in lecture discussions as defined in the content outline.
2. Complete assigned lab activities as required.

OUTLINE OF CONTENT

I. Methods of exposure

A. Contact printing - using negative and printing frame or box; short exposure on fast photographic paper.

B. Enlargement - using enlarger with easel; longer exposure with slow photographic paper.

II. Procedure for enlarging

A. Set up 3 trays: developer, stop bath, and fixer.
NOTE: These are the same as the ones used for making a proof sheet.

B. Mix chemicals according to directions on packages with water that is at a temperature of 68-75 degrees F.

C. Dust negative carefully with a camel's hair brush while holding it by its edges. Be sure to dust both sides of the negative.

D. After selecting the proper negative carrier, dust the glass and place the negative in the carrier with the emulsion side (the dull one) down.

E. To aid in focusing the enlarger, place a piece of white typing paper under the guides of the enlarging easel.

F. Turn on the safelight and turn off other lights.

G. Set the lens of the enlarger to its largest opening (smallest number).

H. After turning the enlarger on, adjust the enlarger height so your picture has the desired negative image within the easel guides.

I. Bring the picture into focus by adjusting the enlarger lens.

J. Now change the lens setting to F-11 and turn the enlarger off.

K. Place the sheet of Kodak Polycontrast Rapid RC Paper on the easel with emulsion side up (shiny side).

L. With a sheet of cardboard cover all the sheet except a sixth. At 5 second intervals expose an additional sixth of the paper. After 30 seconds, turn off the enlarger.

M. Process the test sheet.

1. 1-1/2 minutes in the developer.

2. 5 seconds in the stop bath.

3. Slide into the fixer for 25-30 seconds.

N. Turn on the lights.

O. Inspect the test print and choose the exposure time which gave the best result.

P. Turn out the lights and place a piece of photographic paper into the easel.

Q. Expose the paper and process it as on the test print but with a 2 minute fixing time. After 25-30 seconds turn on the lights.

R. Wash the enlargement for 4 minutes at 65 to 70 degrees F.

S. Use running water and agitate the print frequently while it is washing.

T. Squeegee surface water from both sides of the print.

U. Lay the print on a flat surface to dry at room temperature.

III. Techniques for printing and enlarging

A. Cropping - Using part of the image that is in the negative to make a more pleasing print.

1. Take two L-shaped pieces of paper and place them on the contact print.

2. Move the L-shaped cardboard around until the best looking picture is seen inside the L's.

3. Mark the area to be cropped with a grease pencil.

4. Adjust the enlarger to take in the area marked with the grease pencil and make the enlargement.

B. Vignetting - A technique used in enlargements to eliminate distracting or unwanted backgrounds.

1. Most popular when printing high key portraits (portraits made up of mostly light gray tones).

2. Vignetting is done from a negative through a hole in opaque cardboard.

a. Hole should be the size that gives the desired effect when held halfway between the enlarger lens and the paper.

b. The edges of the cardboard should be feathered or rough-cut so the image fades gradually into the white paper.

3. Keep the vignetter in continuous motion during print exposure.

C. Dodging - Holding back light from the project image during exposure time so that the photographic paper receives less than normal exposure in areas that were too dark in the straight print.

1. Cut the needed shape from a piece of dark cardboard.

2. Tape the cardboard to a piece of wire.

3. While exposing the print, hold the wire attached to the cardboard so the cardboard is over the area which is too dark on the projected image.

4. Move the cardboard and wire while making the exposure so the wire and cardboard image will not show up on the print.

D. Diffusing - Softening detail in a print with a diffusing disk or other material that scatters light. A diffusing disk is a flat glass with a pattern of lines or concentric rings that breaks up and scatters light from an enlarger lens.

E. Burning-in - Giving additional exposure to part of the image projected on an enlarger easel to make that area of the print darker.

1. After the basic exposure extend the exposure time to allow light to hit the light areas for a longer time.

2. Light is withheld from the area which is dark enough by holding dark cardboard over that area.

3. The cardboard should be held halfway between the enlarger lens and the paper.

4. The paper should be kept in constant motion.

5. This proceuure is also called printing-in

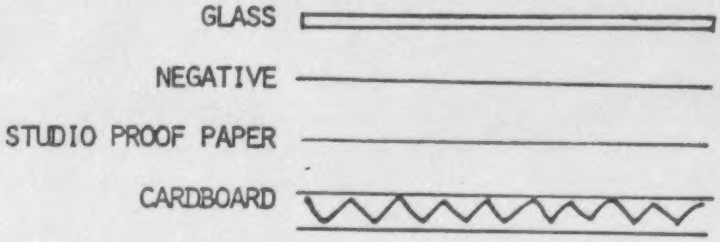
CONTACT PRINTING ON STUDIO PROOF PAPER

Studio proof paper is a special type of photographic paper. Unlike other photographic papers, studio proof paper does not need a chemical developer. It develops right before your eyes in sunlight!

1. Place a small sheet of studio proof paper on a piece of cardboard (emulsion side up).

2. On top of that, place your negative, shiny side up.

3. Now, "sandwich" all this with a piece of glass. See the diagram below.



4. Carefully place this stack of negative, paper, etc., in the sunlight. In just seconds you picture will begin to appear. Let the paper turn deep purple!

5. Now quickly take the developed studio proof paper and swish it in the fixer for 3-5 seconds. It should turn brown in this step!

6. Wash your contact print for 10-15 minutes in running water. All you have left to do now is let your prints air dry!

Student Activity #1

Description: After discussing the topics outlined above, students should be allowed to become familiar with the enlarger equipment by making some prints from their negatives (developed previously).

Teaching Procedures: The teacher should structure this activity to suit the facilities available.

Equipment and Supplies:

Equipment

Developing trays
Timers
Chemical bottles
Graduates
Dryer
Sink with running water
Enlarger with easel
Printing frame or box

Supplies

Developer (See Appendix A for source)
Stop bath (same as film)
Fixer (same as film)
Photographic paper

STEPS IN MAKING CONTACT PRINTS

by Larry Malone

1. Assemble equipment.

2. Place the negative (emulsion side up) on the glass plate.

3. Adjust the masks.

4. Remove a piece of contact paper from the package and place it (emulsion side down) on the negative. Be sure that the remainder of the paper in the package is protected from any light.

5. Hold paper in position with one hand and bring the cover down unti it holds the paper in place.

6. Bring the cover all the way down to the locked position. This begins the exposure.

7. Time the exposure and release the cover catch. The exposed paper is now ready for developing.

8. Remove the exposed paper from the frame and slip it into the developer with a sliding motion. Rock the tray gently and watch the results closely. In about twenty seconds the picture will begin to appear. It should be fully developed in 90 seconds.

9. Transfer to stop bath; rinse for a few seconds; then transfer to hypo fixing bath for five to ten minutes.

10. Wash the print and dry it carefully.

ENLARGING AND DEVELOPING PRINTS ON KODABROME RC PAPER

Enlarging:

1. Mix the needed chemicals and have them immediately available;

    A. Dektol developer

    B. Stop bath

    C. Fixer

    D. Running water

2. Place your developed negative in the carrier of the enlarger. The emulsion or dull side of the negative should be facing down.

3. Adjust the size of your print by raising or lowering the enlarger head. Have the enlarger light on while completing this step.

4. Adjust the focus until the image is sharp on the easel.

5. Turn the enlarger light off! For the remaining steps, only the darkroom safelight should be on!

6. Place a test strip of RC paper on the easel. Make sure the emulsion side is up.

7. Turn on the enlarger, and make a test strip.

8. Develop this test strip (using the following processes). Select the best exposure.

9. Place a full piece of RC paper on the easel. Again, be certain the emulsion side is up.

10. Expose your paper using the time and lens opening you selected.

Developing:

1. Develop your exposed print in the dektol developer for 1-1/2 minutes. This time is constant and should not change! Only change exposure times!

2. Now quickly dip your print in the stop bath solution for 5-10 seconds. Use tongs to do this!

3. Next, put your print in the fixer, agitating for about 10 seconds. Leave your print in the fixer for 2-3 minutes, agitating occasionally.

4. Wash your prints thoroughly in running water. About 10-12 minutes.

5. Kodabrome RC paper will not curl when it dries, unlike some other photographic papers. So all you need to do now is completely air dry your print!

ALWAYS HANDLE PHOTOGRAPHIC NEGATIVES AND PRINTS CAREFULLY! THEY DAMAGE EASILY!

I. An enlargement is a print that is larger than the negative.

A. Set up 3 trays: developer, stop bath, and fixer.

NOTE: These are the same as the ones used for making a proof sheet.

B. Mix chemicals according to directions on packages with water that is at a temperature of 68-75 degrees F.

C. Dust negative carefully with a camel's hair brush while holding it by its edges. Be sure to dust both sides of the negative.

D. After selecting the proper negative carrier, dust the glass and place the negative in the carrier with the emulsion side (the dull one) down.

E. To aid in focusing the enlarger, place a piece of white typing paper under the guides of the enlarging easel.

F. Turn on the safelight and turn off other lights.

G. Set the lens of the enlarger to its largest opening (smallest number).

H. After turning the enlarger on, adjust the enlarger height so your picture has the desired negative image within the easel guides.

I. Bring the picture into focus by adjusting the enlarger lens.

J. Now change the lens setting to F-11 and turn the enlarger off.

K. Place the sheet of Kodak Polycontrast Rapid RC Paper on the easel with emulsion side up (shiny side).

L. With a sheet of cardboard cover all the sheet except a sixth. At 5 second intervals expose an additional sixth of the paper. After 30 seconds, turn off the enlarger.

M. Process the test sheet.

1. 1-1/2 minutes in the developer.
2. 5 seconds in the stop bath.
3. Slide into the fixer for 25-30 seconds.

N. Turn on the lights.

O. Inspect the test print and choose the exposure time which gave the best result.

P. Turn out the lights and place a piece of photographic paper into the easel.

Q. Expose the paper and process it as on the test print but with a 2 minute fixing time. After 25-30 seconds turn on the lights.

R. Wash the enlargement for 4 minutes at 65 to 70 degrees F.

S. Use running water and agitate the print frequently while it is washing.

T. Squeegee surface water from both sides of the print.

U. Lay the print on a flat surface to dry at room temperature.

III. Techniques for printing and enlarging

A. Cropping - Using part of the image that is in the negative to make a more pleasing print.

1. Take two L-shaped pieces of paper and place them on the contact print.

2. Move the L-shaped cardboard around until the best looking picture is seen inside the L's.

3. Mark the area to be cropped with a grease pencil.

4. Adjust the enlarger to take in the area marked with the grease pencil and make the enlargement.

B. Vignetting - A technique used in enlargements to eliminate distracting or unwanted backgrounds.

1. Most popular when printing high key portraits (portraits made up of mostly light gray tones).

2. Vignetting is done from a negative through a hole in opaque cardboard.

a. Hole should be the size that gives the desired effect when held halfway between the enlarger lens and the paper.

b. The edges of the cardboard should be feathered or rough-cut so the image fades gradually into the white paper.

3. Keep the vignetter in continuous motion during print exposure.

C. Dodging - Holding back light from the projected image during exposure time so that the photographic paper receives less than normal exposure in areas that were too dark in the straight print.

1. Cut the needed shape from a piece of dark cardboard.

2. Tape the cardboard to a piece of wire.

3. While exposing the print, hold the wire attached to the cardboard so the cardboard is over the area which is too dark on the projected image.

4. Move the cardboard and wire while making the exposure so the wire and cardboard image will not show up on the print.

D. Diffusing - Softening detail in a print with a diffusing disk or other material that scatters light. A diffusing disk is a flat glass with a pattern of lines or concentric rings that breaks up and scatters light from an enlarger lens.

E. Burning-in - Giving additional exposure to part of the image projected on an enlarger easel to make that area of the print darker.

1. After the basic exposure extend the exposure time to allow light to hit the light areas for a longer time.

2. Light is withheld from the area which is dark enough by holding dark cardboard over that area.

3. The cardboard should be held halfway between the enlarger lens and the paper.

4. The paper should be kept in constant motion.

5. This procedure is also called printing-in.

Information Sheet #2

Terms and Definitions

Blowup - An enlargement; a print that is made bigger than the negative or slide.

Condenser enlarger - An enlarger with a sharp, undiffused light that produces high contrast and high definition in a print.

Contrast - The density range of a negative, print, or slide; the brightness range of a subject or the scene lighting.

Contrast grade - Numbers--usually 0-5--designating the grades available in different photographic papers. Grade 0 has the lowest contrast and grade 5 the highest. The grade 0 paper is designed for use with contrasty negatives to give prints that most closely resemble the original scene. Grade 5 paper is designed for use with low-contrast negatives.

Definition - The impression of clarity of detail perceived by an observer viewing a photograph.

Density - The blackness of an area in a negative or print which determines the amount of light that will pass through it or reflect from it.

Diffusion-condenser enlarger - An enlarger that combines diffuse light with a condenser system, producing more contrast and sharper detail than a diffusion enlarger, but less contrast and blemish emphasis than an condenser enlarger.

Enlargement - A print that is larger than the negative or slide.

Enlarger - A device consisting of a light source, a negative holder and a lens, and a means of adjusting these to project an enlarged image from a negative onto a sheet of photographic paper.

Ferrotype Plate - A chromium-plated or black-enameled sheet of steel, or mirror-plated glass, used to dry prints to a high-gloss finish; the procedure is sometimes defined as "glazing."

Tone - The degree of lightness or darkness in any given area of a print.

Toning - Intensifying or changing the tone of a photographic print after processing. Solutions called "toners" are used to produce various shades of brown and blue.

Student Activity #1

MAKING ENLARGEMENTS

Objective:

You will take the materials given and the negatives and the proof sheet from the previous lessons to complete: enlargements of the pictures you have taken.

Materials:

1 - enlarger

1 - Safelight (used in making contact prints)

4 - trays (used in making contact prints)

1 - darkroom graduate

1 - darkroom thermometer

1 - stirring rod

1 - darkroom timer

1 - rubber squeegee

1 - easel for holding the paper

Kodak Polycontrast Rapid RC Paper

The same chemicals used to make the proof sheet

A camel's hair brush

Procedure:

A. Set up 3 trays: developer, stop bath, and fixer.

NOTE: These are the same as the ones used for making a proof sheet.

B. Mix chemicals according to directions on packages with water that is at a temperature of 68 to 75 degrees F.

C. Dust negative carefully with a camel's hair brush while holding it by its edges. Be sure to dust both sides of the negative.

D. After selecting the proper negative carrier, dust the glass and place the negative in the carrier with the emulsion side (the dull one) down.

E. To aid in focusing the enlarger, place a piece of white typing paper under the guides of the enlarging easel.

F. Turn on the safelight and turn off other lights.

G. Set the lens of the enlarger to its largest opening (smallest number).

H. After turning the enlarger on, adjust the enlarger height so your picture has the desired negative image within the easel guides.

I. Bring the picture into focus by adjusting the enlarger lens.

J. Now change the lens setting to F-11 and turn the enlarger off.

K. Place the sheet of Kodak Polycontrast Rapid RC Paper on the easel with emulsion side up (shiny side).

L. With a sheet of cardboard cover all the sheet except a sixth. At 5 second intervals expose an additional sixth of the paper. After 30 seconds, turn off the enlarger.

M. Process the test sheet.

1. 1-1/2 minutes in the developer.
2. 5 seconds in the stop bath.
3. Slide into the fixer for 25-30 seconds.

N. Turn on the lights.

O. Inspect the test print and choose the exposure time which gave the best result.

P. Turn out the lights and place a piece of photographic paper into the easel.

Q. Expose the paper and process it as on the test print but with a 2 minute fixing time. After 25-30 seconds turn on the lights.

R. Wash the enlargement for 4 minutes at 65 to 70 degrees F.

S. Use running water and agitate the print frequently while it is washing.

T. Squeegee surface water from both sides of the print.

U. Lay the print on a flat surface to dry at room temperature.

UNIT TEST

Match the following terms with the description which best describes the term. Place the letter of your answer in the blank before each statement.

____ 1. A print that is larger than the negative or slide.

____ 2. The degree of lightness or darkness in any area of a print.

____ 3. The blackness of an area in a negative or print which determines the amount of light that will pass through it or reflect from it.

____ 4. Softening detail in a print with a diffusing disk or other material that scatters light.

____ 5. Holding back light from the projected image during exposure time so that the photographic paper receives less than normal exposure in areas that were too dark in the straight print.

____ 6. Giving additional exposure to part of the image projected on an enlarger easel to make that area of the print darker.

____ 7. Using part of the image that is in the negative to make a more pleasing print.

____ 8. A means of eliminating unwanted backgrounds by projecting light through a hole in opaque cardboard.

____ 9. A device consisting of a light source, a negative holder, and a lens, and a means of adjusting these to project an enlarged image from a negative onto a sheet of photographic paper.

____10. An enlarger with a sharp-undiffused light that produces high contrast and high definition in a print.

A. Tone

B. Cropping

C. Density

D. Condenser enlarger

E. Vignetting

F. Enlargement

G. Burning-in

H. Diffusion

I. Enlarger

J. Dodging

ANSWERS TO TEST

1. F
2. A
3. C
4. H
5. J
6. G
7. B
8. E
9. I
10. D

REFERENCES/RESOURCES

I. References

A. *Basic Developing, Printing, Enlarging in Black and White,* Eastman Kodak Company #AJ-2, Consumer Markets Division, Rochester, New York: 1977.

B. CBIE Project, *Industrial Education Visual Communication Revised,* Kansas State Department of Education, Wichita, Kansas.

C. Gerac, Philip G, Mangione, Stephen S., *Communication: Photography,* MET Series, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976.

D. Muse, Ken, *Photo One,* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1973.

II. Resources

A. Information Sheets

B. Activity Sheets

C. Demonstrations

EQUIPMENT/SUPPLIES

I. Equipment

6 - Easels for holding photographic paper

24 - Trays 8 x 10 inches

6 - Stirring rods

6 - Darkroom graduates

8 - Large jars

6 - Darkroom timers

6 - Rubber squeegees

6 - Enlargers

6 - Camel's hair brushes

6 - Darkroom thermometers

II. Supplies

A. 100 sheets (4 packages) of Kodak Polycontrast Rapid RC Paper, 8 x 10 inches.

B. 2 gallons of Kodak Dektol Developer

C. Use the Kodak Indicator Stop Bath and Kodak Fixer left over from other darkroom work.

PHOTOGRAPHIC CAREER OPPORTUNITIES

UNIT OBJECTIVES:

Upon completion of this unit, the students will have a basic understanding of what career opportunities exist in the photographic communications industry and job duties associated with the different employment positions.

CONTENT OUTLINE:

1. Nature of work.

2. Analysis of job attributes.

3. Job titles.

TEACHER ACTIVITIES:

1. Make transparencies.

2. Present information relevant to the content outline.

3. Attend classroom discussions relating to job opportunities.

4. Prepare handouts of job descriptions.

5. Arrange for members of the local photographic communications industries to address the class concerning careers in photographic communication.

STUDENT ACTIVITIES:

1. Participate in lecture discussions as defined by the content outline.

2. Select one career position (job title) and prepare an in-depth presentation for the class on potential within the local community.

U.S.O.E. Career Cluster:

COMMUNICATIONS

Occupational Family:

PHOTOGRAPHY

NATURE OF WORK

Photographers use their cameras and film to portray people, places, and events much as a writer uses words. Those who are skillful can capture the personality of individuals or the mood of scenes which they photograph. Although their subject matter varies widely, all photographers use the same basic equipment. The most important piece, of course, is the camera, and most photographers own several. Professional cameras use a variety of lenses designed for close-up, medium-range, or distance photography.

Besides cameras and lenses, photographers use a variety of film and colored filters to obtain the desired effect under different lighting conditions. When taking pictures indoors or after dark, they use electronic flash units, floodlights, reflectors and other special lighting equipment.

Some photographers develop and print their own photographs in the darkroom and may enlarge or otherwise alter the basic image. Many photographers send their work to photographic laboratories for processing.

Many photographers specialize in a particular type of photography, such as portrait, commercial, or industrial work. Portrait photographers take pictures of individuals or groups of persons and often work in their own studios. For special events, such as weddings or christenings, however, they take photographs in churches and homes. Commercial photographers photograph a wide range of subjects including livestock, manufactured articles, buildings, and large groups of people. They frequently do photography for catalogs. Advertising photographers must know how to use many different techniques. The work of industrial photographers is used in company publications to report to stockholders or to advertise company products or services. They also photograph groups of people for employee news magazines.

ANALYSIS OF JOB PREREQUISITES

Photographic training is available in colleges, universities, junior colleges, and art schools. Although a high school education is desirable, the photography profession has no set entry requirements with regard to formal education or training. Photographers must have good eyesight and color vision, artistic ability, and manual dexterity. They also should be patient and accurate and enjoy working with detail. Some knowledge of mathematics, physics, and chemistry is helpful for understanding the uses of various lenses, films, light sources, and development processes. Photographers must be imaginative and original in their thinking. The portrait photographer needs the ability to help people relax in front of the camera.

ANALYSIS OF JOB ATTRIBUTES

Over 75 colleges and universities, junior colleges, and art schools offer four-year curriculums leading to a bachelor's degree in photography. Some colleges have a two-year curriculum leading to a certificate or associate degree in photography. Art schools offer a useful training in design and composition. The Armed Forces also train many young people in photographic skills. People may prepare for work as photographers in a commercial studio through two or three years of on-the-job training as a photographer's assistant. Trainees generally start in the darkroom where they learn to mix chemicals, develop film, and do photoprinting and enlarging. Later they may set up lights and cameras or help an experienced photographer take pictures.

Photographers with exceptional ability may gain national recognition for their work and exhibit their photographs in art and photographic galleries, or publish them in books. A few industrial photographers may be promoted to supervisory positions. Magazine and news photographers may eventually become heads of graphic arts departments or photography editors.

Employment of photographers is expected to grow more slowly than the average for all occupations through the mid 1980's. In addition to openings, resulting from growth, others will occur each year as workers die, retire, or transfer to other occupations. Photography is becoming an increasingly important part of law enforcement work, as well as scientific and medical research, where opportunities are expected to be good for those possessing a highly specialized background. The employment of portrait and commercial photographers is expected to grow slowly, and competition for jobs and commercial photographers is expected to be keen.

Photographers who have salaried jobs usually work a 5-day, 35-40 hour week and receive benefits such as paid holidays, vacations, and sick leave. Those in business for themselves usually work longer hours. Freelance, press, and commercial photographers travel frequently and may have to work in uncomfortable surroundings. Sometimes the work can be dangerous, especially for news photographers assigned to cover stories on natureal disasters or military conflicts.

Newspaper photographers with some experience (usually four or five years) averaged about $320 a week in 1976. Almost all experienced newspaper photographers earned over $225; the top salary was nearly $505 a week. Experienced photographers generally earn salaries that are above the average for non-supervisory workers in private industry, except farming. Although self-employed and freelance photographers often earn more than salaried workers, their earnings are affected greatly by general business conditions and the type and size of their community and clientele.

Job titles for this Instructional Program are:

Title	D.O.T.
Photographer	143.062.034
Aerial Photographer	143.062.014
Photographic Retoucher	970.281.018
Camera Repairer	714.281.014
Photo Spotter	970.381.034
Film Processing Supervisor	976.132.010
Automatic Developer	976.685.014
Print Cutter	976.685.010
Automatic Print Developer	976.685.026
Film Processing Utility Work	976.685.030
Color-Printer Operator	976.382.014
Film Developer	976.382.014
Black-and-white Printer Operator	976.682.014
Still Photographer	143.062.030
Finish Photographer	143.382.014
Developer	976.681.010
Photo Finisher	976.487.010
Photographer Helper	976.667.010
School Photographs Detailer	976.564.010
Finishing Department Supervisor	976.137.014
Quality-Control Technician	976.261.010
Print Controller	976.360.010
Reproduction Technician	976.361.010
Print Washer	976.684.022
Photofinishing Laboratory Worker	976.687.018
Photo Checker and Assembler	976.687.014
Print Inspector	976.687.022

SOURCES OF ADDITIONAL INFORMATION

Photographic Art and Science Foundation
111 Stratford Rd.
Des Plaines, Ill 60016

Professional Photographers of America, Inc.
1090 Executive Way
Des Plaines, Ill 60018

Dictionary of Occupational Titles, Fourth Edition, 1977.

Occupational Outlook Handbook, 1978-79 Edition.

Encyclopedia of Careers and Vocational Guidance, 1978 Edition.

GUIDE - Worker Trait Group, 1978.

COMMUNICATIONS

JOB STRUCTURE: PHOTOGRAPHY

JOB TITLE: Aerial Photographer
D.O.T. No.: 143.062.014

Major Job Function:

Photographs segments of earth and other subject material from aircraft to produce pictures used in surveying, mapping, and related purposes such as recording effects of pollution or natural disasters, determining condition of crops and timberland, and planning cities or other large scale projects.

Job Duties:

1. Sets up and mounts camera in aircraft.

2. Confers with pilot regarding plotted course, speed, altitude, and area to be photographed.

3. Communicates with pilot during flight to insure adherence to flight plan or make adjustments to equipment to compensate for changes.

4. Calculates number of exposures and time lapse between them, using standard formulas to determine requirements for adequate area coverage.

5. Adjusts camera shutter speed, lens aperture opening, and focus.

6. Adjusts automatic exposure interval on camera equipped with time lapse control or times intervals with stopwatch and manually trips shutter.

7. Maintains camera in level position and oriented to flight path when making photographs for mapping or surveying.

JOB TITLE: Still Photographer
D.O.T. No.: 143.062.030

Major Job Function:

Photographs subjects using still camera, color or black-and-white film, and a variety of photographic accessories.

Job Duties:

1. Selects and assembles equipment according to subject material, anticipated conditions, and knowledge of function and limitations of various types of cameras, lenses, films and accessories.

2. Views subject and setting and plans composition, camera position, and camera angle to produce desired effect.

3. Arranges subject material, poses subject, or maneuvers into position to take candid photo.

4. Estimates or measures light level, using light meter or creates artificial lighting with flash units, lights, and lighting equipment.

5. Adjusts lens aperture and shutter speed based on combination of factors, such as lighting, depth of field, subject motion, and film speed.

6. Determines subject to lens distance, using tape measure, range finder, ground glass, or reflex viewing system to adjust focus.

7. Positions camera and trips shutter to expose film.

JOB TITLE: Photographer
D.O.T. No.: 143.062.034

Major Job Function:

Photographs people, events, locations or other illustrative or educational materials for amusement and recreation or for use in publications or telecasts, using still cameras.

Job Duties:

1. Travels to assigned location and takes pictures.

2. Develops negatives and prints film.

3. Submits negatives and pictures to customers or to editorial personnel.

4. Takes portraits by use of lighting arrangements to achieve different effects.

5. Works in studio or may go to home of individual to make a special portrait.

6. May specialize in one phase of photography, as news, sports, special features, or as a freelance photographer.

JOB TITLE: Finish Photographer
D.O.T. No.: 143.382.014

Major Job Function:

Operates photographic equipment to photograph finish of horse races.

Job Duties:

1. Loads film into camera and advances to picture taking position.

2. Sights camera on finish line and adjusts exposure controls and focus.

3. Observes race and starts camera as horses approach finish line.

4. Stops camera after last horse has crossed finish line.

5. Remove exposed film from camera and places it into film-developing machine that automatically develops film.

6. Prints and enlarges photographs used to determine winner of race when finish is close.

JOB TITLE: Photographic Retoucher
D.O.T. No.: 970.281.018

Major Job Function:

Retouches photographic negatives and prints to accentuate desirable features of subjects, using pencils or watercolors and brushes.

Job Duties:

1. Examines negative to determine which features should be accentuated or minimized.

2. Paints negative with retouching medium so that retouching pencil will mark surface of negative.

3. Shades negative with pencil to smooth facial contours, conceal stray hairs, wrinkles, or blemishes, and soften harsh highlights.

4. Brushes watercolors on print to accentuate lights and shadows and produce clear and attractive features.

JOB TITLE: Photo Spotter
D.O.T. No.: 970.381.034

Major Job Function:

Covers or spots out imperfections on photographic prints, using gloved finger, brush, or pencil.

Job Duties:

1. Positions print under viewing light or on illuminated table and examines print to detect defects, such as surface blemishes, dust spots, and uneven margins.

2. Selects premixed paint or mixes paint, using color charts, when repairing color prints.

3. Applies paint to defective area of color print, using glove finger or artist's brush.

4. Shades light areas on black-and-white prints, using pencil.

5. Rubs surface of photograph with cloth to remove debris and reduce gloss.

6. Trims edges of print to enhance appearance, using scissors or paper cutter.

7. Places prints in customer bag and records number per bag or mounts print in specified frame.

JOB TITLE: Film Processing Supervisor
D.O.T. No.: 976.132.010

Major Job Function:

Supervises and coordinates activities of workers engaged in photo-finishing operations, such as preparing photographic negatives and paper, and developing, sorting, and checking prints.

Job Duties:

1. Trains new workers and demonstrates new techniques to improve skills of experienced workers.

2. Flips switches and turns controls on master panelboard to start photographic processing equipment, admit solutions to processing tanks, and to adjust solution temperature and flow rate.

3. Monitors operation of machinery and equipment to detect defective parts.

4. Repairs defects, such as loose nuts and bolts, and notifies maintenance department when major repairs are required.

5. May perform duties of subordinates to maintain production or to replace absent worker.

6. Performs other duties as described under Supervisor.

JOB TITLE: Finishing Department Supervisor
D.O.T. No.: 976.137.014

Major Job Function:

Supervises and coordinates activities of workers engaged in cutting, checking, spotting, mounting, pricing, and packaging film negatives and prints to prepare orders for shipment.

Job Duties:

1. Plans and conducts training programs for new workers and to improve skills of experienced workers.

2. Inspects work in progress to verify consistency of workers' decisions with company standards.

3. Inspects equipment, makes minor adjustments, and confers with maintenance personnel to schedule major repairs.

4. Reviews price listings of merchandise and indicates price changes on listings according to instructions from management.

5. Requisitions supplies according to worker requirements and records of supplies on hand.

JOB TITLE: Quality-Control Technician
D.O.T. No.: 976.261.010

Major Job Function:

Examines photographic prints, processed film, cameras and other photographic equipment for defects or faulty operation to determine course of action required to satisfy customer complaints.

Job Duties:

1. Reviews unresolved requests for adjustment of complaints and reads customer comments to determine basis of complaints and plan of action needed to resolve complaint.

2. Spreads negatives and prints on illuminated worktable and uses magnifying glass to detect defects, such as incorrect coloring, shading, or cutting.

3. Determines cause of defect and type correction required based on knowledge of photo processing and finishing techniques.

4. Prepares memorandum to processing department and confers with

supervisor to suggest remedies to prevent subsequent errors in processing.

5. Contacts customer to explain causes for defects and confers with sale-service personnel to resolve technical questions and to demonstrate correct usage of photographic equipment.

6. Prepares reports indicating complaints handled and dispositions made.

JOB TITLE: Print Controller
D.O.T. No.: 976.360.010

Major Job Function:

Sets up and adjusts photographic print developing equipment according to density, color, and size of prints.

Job Duties:

1. Positions on film in densitometer, reads dials, and records findings on plot sheet to locte defects in density and color balance.

2. Confers with Supervisor, Quality Control to determine adjustments required to bring print machine into balance.

3. Runs test film strip through print machine to evaluate machine exposure.

4. Removes cover from control panel of print machine to gain access to control shafts and adjustment knobs, using wrench.

5. Plugs electric timer into printer to determine time elapsed during printing operation.

6. Starts equipment, observes timer, and adjusts shafts and knobs to attain specified process settings, using handtools.

7. Locks control shafts of printer into position subsequent to final adjustment to prevent shifting in color or density balance during printing.

8. Keeps records of adjustments made for departmental use.

JOB TITLE: Reproduction Technician
D.O.T. No.: 976.361.010

Major Job Function:

Duplicates printed material on sensitized paper, cloth, or film according to customer specifications, using photographic equipment and handtools.

Job Duties:

1. Reads work order and confers with supervisor to determine processes, techniques, equipment, and materials required.

2. Places original on sensitized material in vacuum frame.

3. Mounts camera on tripod or stand and loads prescribed type and size film in camera.

4. Sets camera control to regulate exposure time according to line density of original and type of sensitized material.

5. Activates camera to expose sensitized material, impri original on material.

6. Develops exposed material.

7. Examines developed reprint for defects, such as broken lines, spots, and blurs, and touches up defects, using chemicals, inks, brushes, and pens.

JOB TITLE: Color-Printer Operator
D.O.T. No.: 976.382.014

Major Job Function:

Controls equipment to produce color prints from negatives.

Job Duties:

1. Reads customer instructions to determine processing requirement.

2. Loads roll of magazine of printing paper into color printing equipment.

3. Examines color negative to determine equipment control settings for production of prints meeting acceptable color-fidelity standards.

4. Sets controls in accordance with examination, loads negative into machine, and starts machine to produce specified number of prints.

5. Removes printed photographic paper from machine and places paper in film bag for further processing or in developing machine.

6. Inspects finished prints for defects, such as dust and

smudges, and removes defects, using brush, cloth, and cleaning fluid.

7. Inserts processed negatives and prints into envelope for return to customer.

JOB TITLE: School Photographs Detailer
D.O.T. No.: 976.564.010

Major Job Function:

Performs a variety of tasks to prepare and disseminate school photographs.

Job Duties:

1. Reads photographers' work orders and records information, such as number of prints and type finish specified as a guide for processing film.

2. Assigns control number to each order.

3. Records customer charges on worksheet and submits to accounting department for billing.

4. Sorts and bags film according to processing required.

5. Cuts prints to prepare composite for group photographs, using chopping block, die, and mallet.

6. Assembles composite and mails to picture service for processing of negative.

7. Routes composite negative to printing section and records cost of composite service.

8. Feeds specified photographs in gluing machine that automatically applies adhesive backing to photographs.

9. Confers with photographers to resolve complaints regarding missing or defective photographs.

10. Cuts out, arranges, and pastes letters, number, and pictures to design advertising circulars.

11. Maintains records indicating orders received, unit prices charged, and department earnings.

JOB TITLE: Film Developer
D.O.T. No.: 976.382.018

Major Job Function:

Operates machine to develop still or motion-picture film.

Job Duties:

1. Pulls film strips through trapdoor into darkroom.

2. Examines film to determine type processing required, utilizing knowledge of film developing techniques.

3. Feels edges of film to detect tears and repairs film using hand stapler.

4. Mounts film in guide slot of developing machine according to length of time required for processing and pulls lever to lower film into processing position.

5. Flips switch to start machine that transports film through series of solutions and into drying cabinet to develop and dry film.

6. Observes film passing through machine to determine density of image and adjusts machine controls to shorten or lengthen path of film through solutions according to observation.

JOB TITLE: Photo Finisher
D.O.T. No.: 976.487.010

Major Job Function:

Performs any combination of the following tasks to dry, trim, and mount photographic prints.

Job Duties:

1. Places washed print on conveyor leading to heated rotating cylinder that dries and flattens print.

2. Trims print edges, using paper cutter or scissors.

3. Inserts print in specified frame or mounts print on material, such as paper, cardboard, or fabric, using cement or hand-operated press.

4. Inserts print and corresponding negative in computer envelope.

5. Computes price of order, according to size and number of prints, and marks price on customer envelope.

JOB TITLE: Black-and-White Printer Operator
D.O.T. No.: 976.682.014

Major Job Function:

Operates printer to produce black-and-white photographic prints from negatives.

Job Duties:

1. Mounts roll of sensitized paper on spindle of printer and threads paper through guides, rollers, and onto take-up spindle.

2. Prepares batch identification sheet, positions sheet in printer, and activates printer to transfer information from sheet to sensitized paper.

3. Prints identification number on customer envelope, using stamping machine.

4. Remove negative strip or single negative from envelope and cleans negatives to remove dust particles, using air blower or gloved finger.

5. Inserts negative in printer and examines image to determine whether picture setting is in or out of doors.

6. Activates printer and adjusts control knobs to produce photographic prints of required shading and density.

7. Places printed roll in envelope and seals envelope to prevent exposure to light.

JOB TITLE: Print Washer
D.O.T. No.: 976.684.022

Major Job Function:

Washes and dries photographic prints, using print-washing pan and blotter, and wringer.

Job Duties:

1. Places developed prints in print-washing pan and activates mechanism that rotates pan to wash prints.

2. Immerses prints in chemical solution subsequent to washing cycle to increase flexibility of prints.

3. Dries prints, using blotter, or positions prints on metal plates, and dries prints, using wringer.

4. Inserts prints in rack on open-faced frames to complete drying process.

5. May examine prints for stains and other defects and return defective prints to developing room.

JOB TITLE: Print Cutter
D.O.T. No.: 976.685.010

Major Job Function:

Tends automatic or semi-automatic machines that cut processed film or prints into single or multiple units.

Job Duties:

1. Examines film or print roll to determine size, number of cuts required, and type machine to use.

2. Turns setscrews to adjust machine guides to roll width and sets density meter on automatic machine to coincide with sensitized marks on roll that control release of cutting blade.

3. Threads roll through machine guides and starts machine that automatically cuts roll into individual or multiple units or depresses pedal of semiautomatic machine to cut roll.

4. Cuts roll of non-standard width, using scissors or hand-operated paper cutter.

5. Inserts units in customer envelope.

6. Keeps production records.

JOB TITLE: Photographer Helper
D.O.T. No.: 976.667.010

Major Job Function:

Assists Still Photographer in taking and developing photographs.

Job Duties:

1. Arranges lights and screens, sets up camera at proper angle, and moves objects to secure desired background for photographs as directed.

2. Assists in darkroom duties, such as mixing chemical solutions and developing films.

3. Labels photographs.

JOB TITLE: Developer
D.O.T. No.: 976.681.010

Major Job Function:

Develops exposed photographic film or sensitized paper in series of chemical and water baths to produce negative or positive prints.

Job Duties:

1. Mixing, developing and fixing solutions, following formula.

2. Immerses exposed film or photographic paper in developer solution to bring out latent image.

3. Immerses negative or paper in stop-bath to arrest developer action, in hyposolution to fix image, and in water to remove chemicals.

4. Dries prints or negatives, using sponge or squeegee, or places them in mechanical air drier.

JOB TITLE: Automatic Developer
D.O.T. No.: 976.685.014

Major Job Function:

Tends machine that develops sheets, strips, or continuous roll of film preparatory to printing.

Job Duties:

1. Pulls film through trapdoor into darkroom.

2. Strips paper backing from film and attaches identifying label.

3. Feels edges of film to detect tears and repairs film, using stapler.

4. Reads work order or feels film for size or notches to determine type of process and developing time required.

5. Positions racks of film on machine chain links according to developing time required or threads leader of continuous roll through machine preparatory to processing.

6. Activates machine that automatically transports film through series of chemical baths to develop, fix, harden, bleach, and wash film.

7. Listens for sounds that indicate machine malfunctioning and notifies supervisor or maintenance personnel when repairs are needed.

JOB TITLE: Automatic Print Developer
D.O.T. No.: 976.685.026

Major Job Function:

Tends one or more machines that automatically develop, fix, wash, and dry photographic prints.

Job Duties:

1. Threads leaders (paper strips) around rollers, through processing tanks and dryer, around polished drum, and onto takeup reel.

2. Turns valves to fill tanks with premixed solutions, such as developer, dyes, stop-baths, fixers, bleaches, and washes.

3. Moves thermostatic control to keep steam-heated drum at specified temperature.

4. Splices sensitized paper to leaders, using tape.

5. Starts machine and throws switches to synchronize drive speeds of processing and drying units.

6. Compares processed prints with color standard and reports variation to control department.

7. Adds specified amounts of chemical to renew solutions.

8. Maintains production records.

JOB TITLE: Photo Checker and Assembler
D.O.T. No.: 976.687.014

Major Job Function:

Inspects, assembles, and packs mounted or unmounted negatives, color film transparencies, and photographic prints.

Job Duties:

1. Examines items for natural color shading density, sharpness of image, or identifying numbers, using lighted viewing screen.

2. Marks defective prints, using grease pencil and standardized

symbols to indicate nature of defect and corrective action required in reprinting.

3. Removes defects, such as dust and smudges from prints, using brush, cloth, and cleaning fluid.

4. Packages and labels satisfactory prints and negatives.

5. Maintains daily production records.

JOB TITLE: Photofinishing Laboratory Worker
D.O.T. No.: 976.687.018

Major Job Function:

Performs any combination of following tasks to prepare and disseminate negatives, positives, and prints in photofinishing laboratory.

Job Duties:

1. Reads instructions written on orders, and examines contents of orders to ascertain size, type, and number of pieces.

2. Sorts orders according to size and type of processing equipment.

3. Pastes identifying label on customer order and envelopes and transfer bags to insure matching of orders subsequent to processing.

4. Removes finished work from transfer bags subsequent to processing and computes customer charges according to price list.

5. Inserts order in bag or envelope, and staples bag together or seals envelope.

6. Pastes address label on bag or envelope.

JOB TITLE: Film Processing Utility Worker
D.O.T. No.: 976.685.030

Major Job Function:

Performs a variety of tasks to assist or substitute for other workers in a photo-finishing laboratory.

Job Duties:

1. Sorts prints according to size and order number to facilitate handling.

2. Tends automatic cutting machine that cuts roll into individual prints (Cutter).

3. Tends automatic film developing machine that develops and fixes image on film (Developer, Automatic).

4. Removes prints from print developer rinse tray and tends drum-type dryer that dries prints.

5. Prepares daily production sheet noting quantity and kind of work performed.

JOB TITLE: Print Inspector
D.O.T. No.: 976.687.022

Major Job Function:

Inspects photographic prints for defects, using film winder.

Job Duties:

1. Mounts roll of prints on spindle of film winder and tapes free end of film to crankshaft.

2. Turns crank and inspects prints for defects as film winds onto crankshaft.

3. Compares colors with standard image to insure that prints meet specifications.

4. Marks defective prints with code number, using chemical pencil, to indicate nature and degree of correction required.

JOB TITLE: Camera Repairer
D.O.T. No.:

Major Job Function:

Repairs and adjusts cameras, using specialized tools and test devices.

Job Duties:

1. Disassembles camera, using handtools.

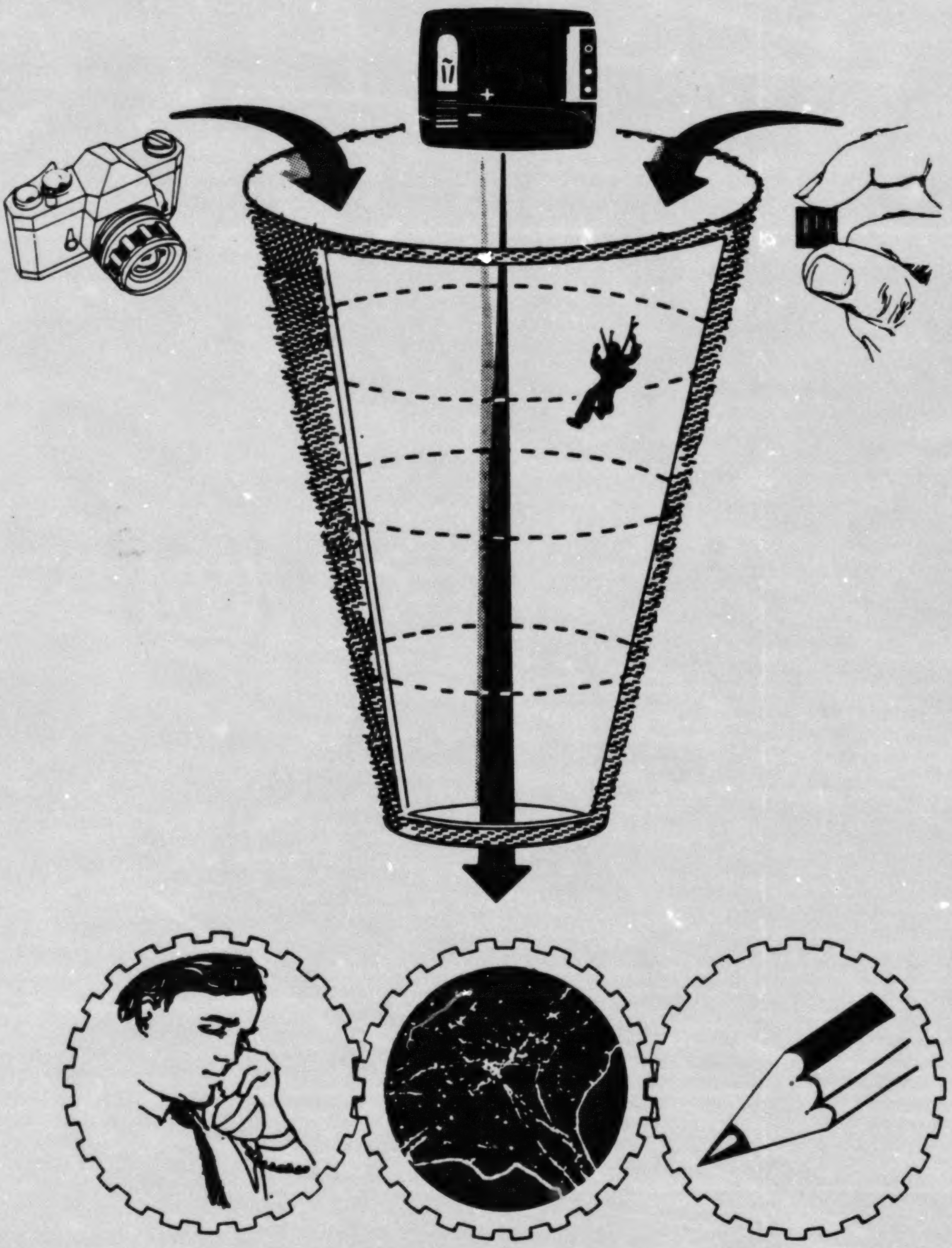
2. Tests and aligns diaphragm, lens mounts, and film transport to minimize optical distortion, using precision gauges.

3. Adjusts range and view finders, using fixed focusing target.

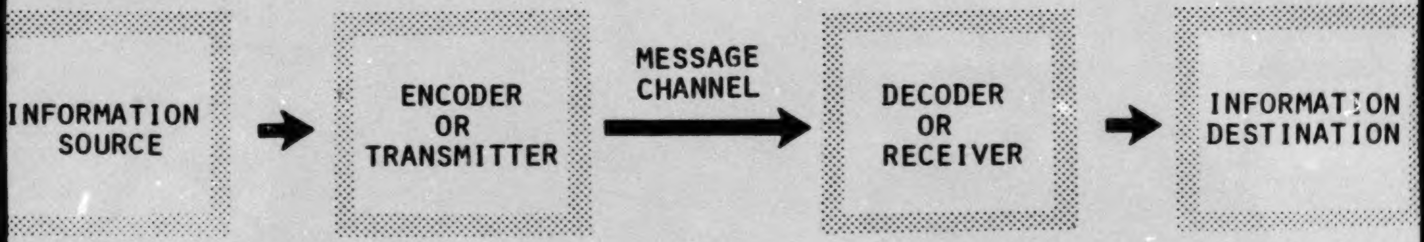
4. Calibrates operation of shutter, diaphragm, and lens carriers with dial setting, using electronic or stroboscopic timing instruments.

5. Fabricates or modifies parts, using bench lathe, grinder, and drill press.

TRANSPARENCY MASTERS



BASIC COMMUNICATION MODEL



INFORMATION SOURCE

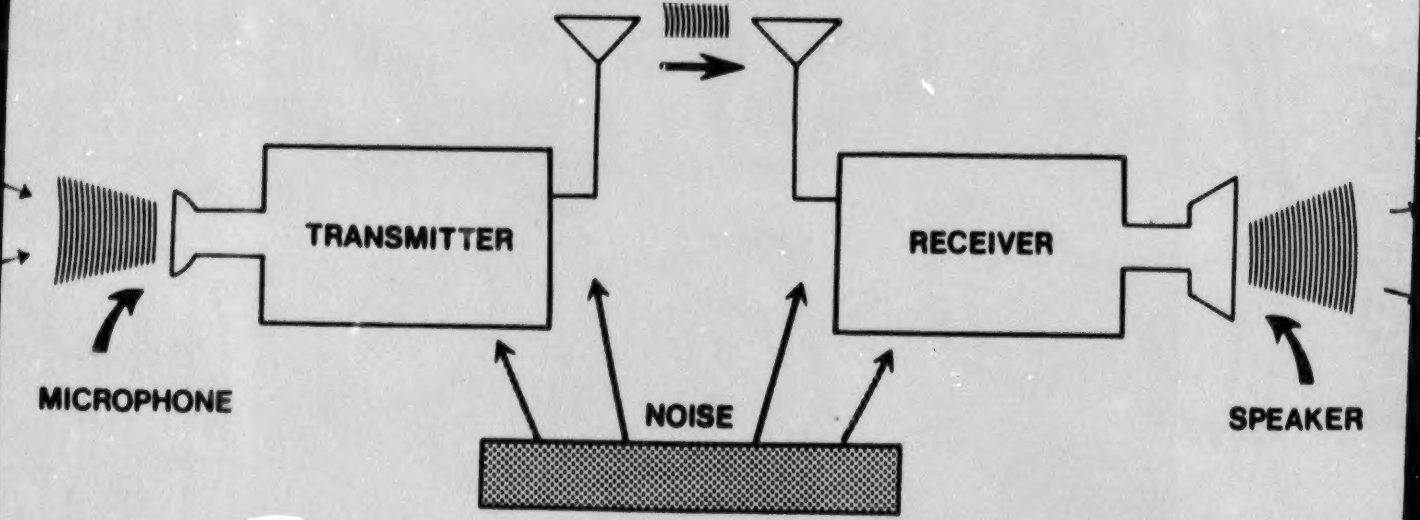
ENCODER OR TRANSMITTER

MESSAGE CHANNEL

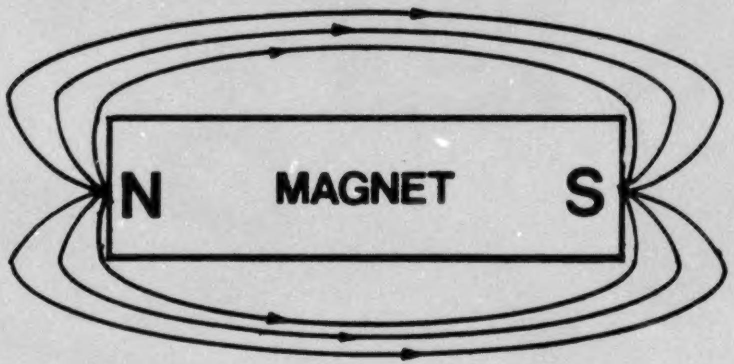
DECODER OR RECEIVER

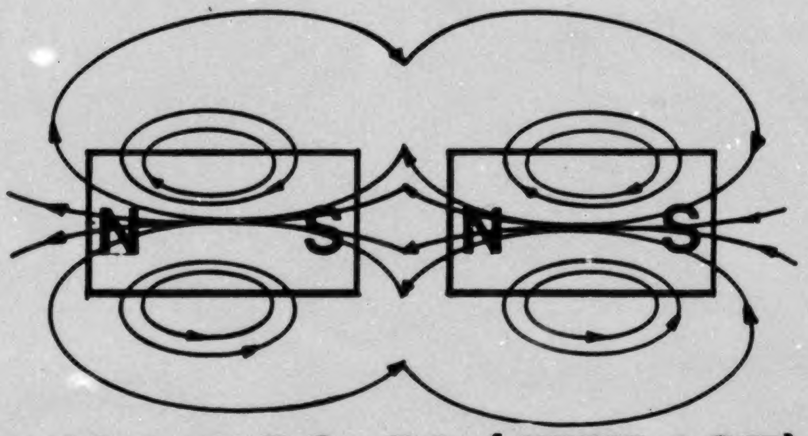
INFORMATION DESTINATION

PRACTICAL ONE-WAY COMMUNICATIONS MODEL

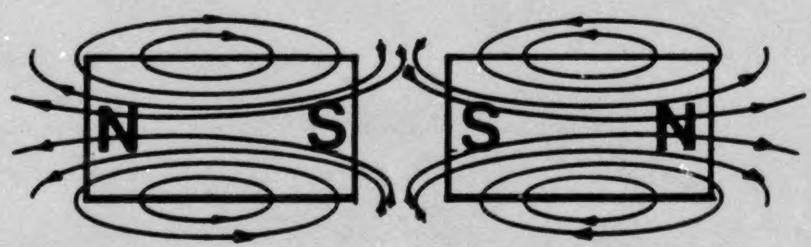

TRANSMITTER
RECEIVER
MICROPHONE
NOISE
SPEAKER

MAGNETISM





UNLIKE POLES (ATTRACT)



LIKE POLES (REPEL)

MEASURING CURRENT & VOLTAGE

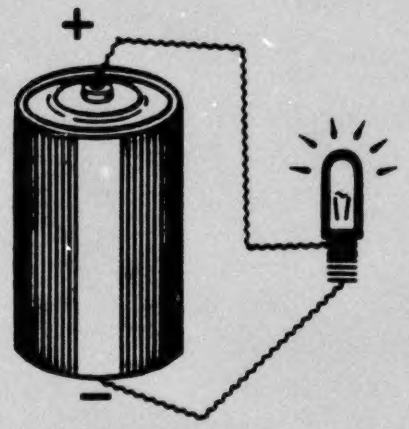


FIGURE 1

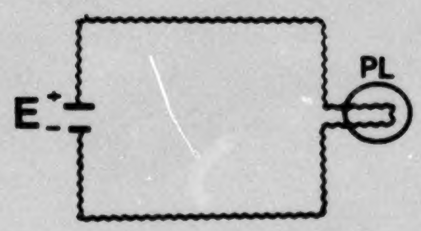


FIGURE 2

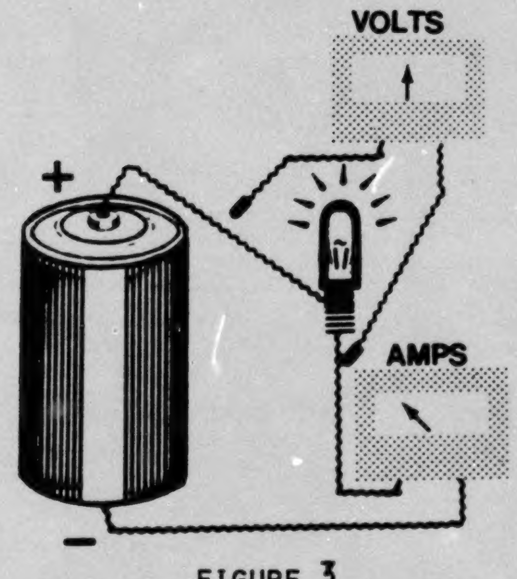


FIGURE 3

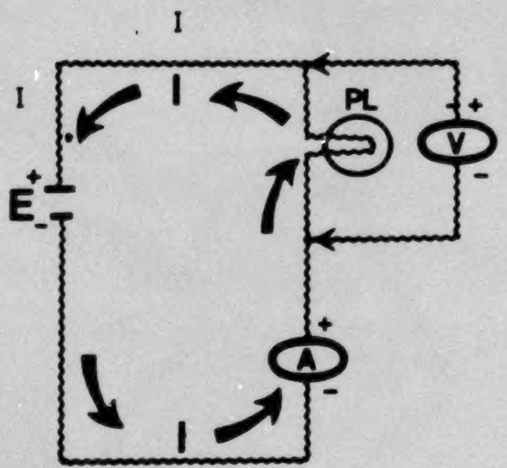


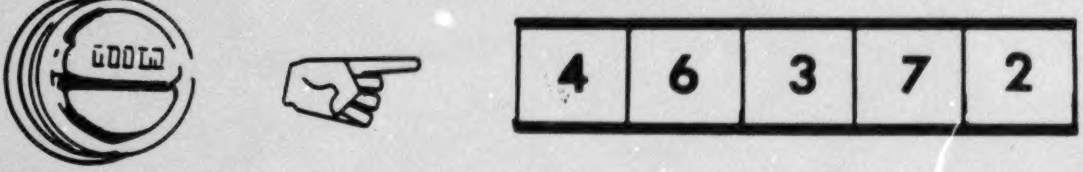
FIGURE 4

CURRENT (AMPS) IS MEASURED IN SERIES WITH THE CIRCUIT.

VOLTAGE (VOLTS) IS MEASURED IN PARALLEL WITH THE CIRCUIT.

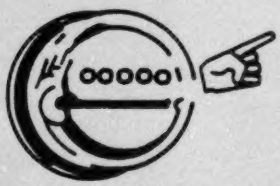
HOW TO READ THE WATT HOUR METER

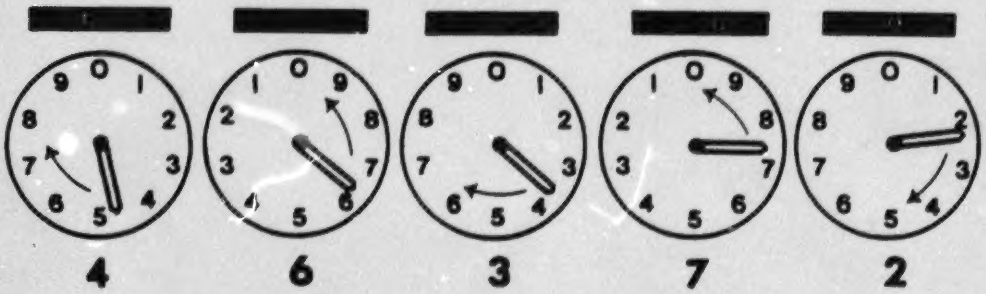
If you have a meter like this (digital), just write down the numbers.



If your meter looks like this (dials), read the right one first. Write down the last number the hand has passed.

Look! some of the hands turn right and some turn left.

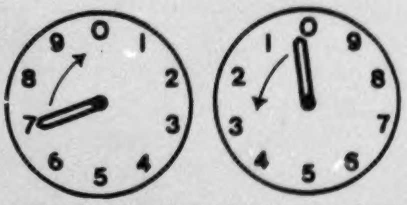




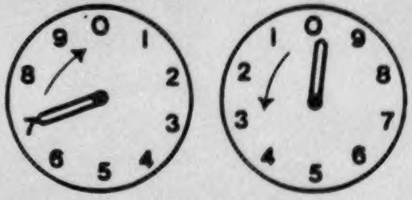
Take the last reading from the new reading.

46372 new reading
45109 last reading
1263 amount of kilowatthours you have used

This is the way to read a meter. But there is one more thing. If a hand is right on a number and you don't know if it has passed or not, then do this. Look at the dial to the right. Has the hand passed 0?



If this dial on the right *has passed 0,* write down the number the hand on the left is pointing to. In this case "7".

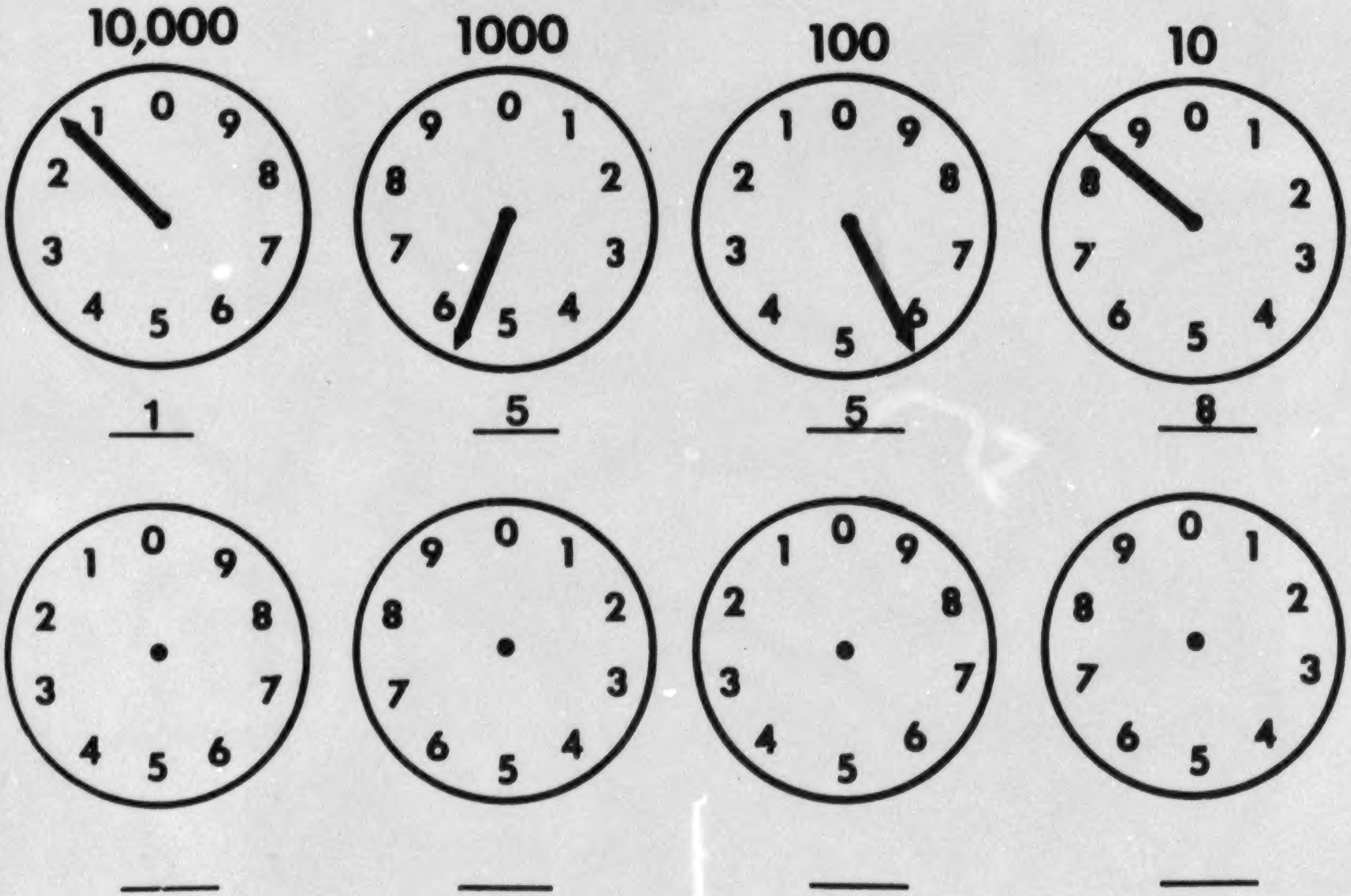


If the dial on the right has *not* passed 0, write down the number the dial on the left has just passed. In this case "6".

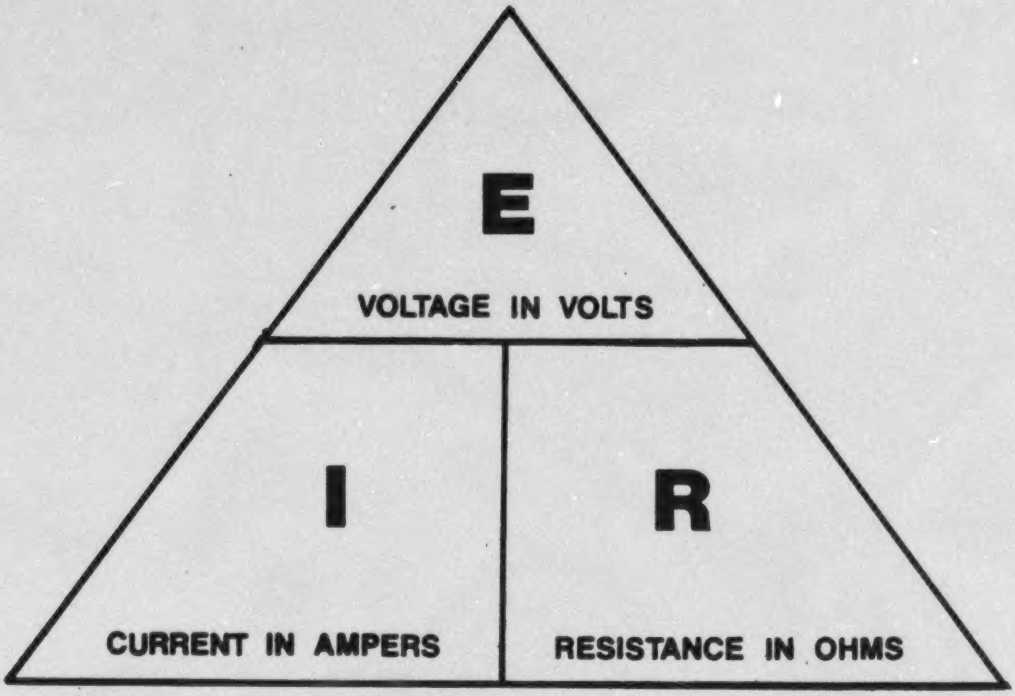
WEEK OF:	METER READING

Use Electricity Wisely

READING WATT HOUR METERS


10,000
1000
100
10
1
5
5
8

OHM'S LAW


E
VOLTAGE IN VOLTS
I
CURRENT IN AMPERS
R
RESISTANCE IN OHMS

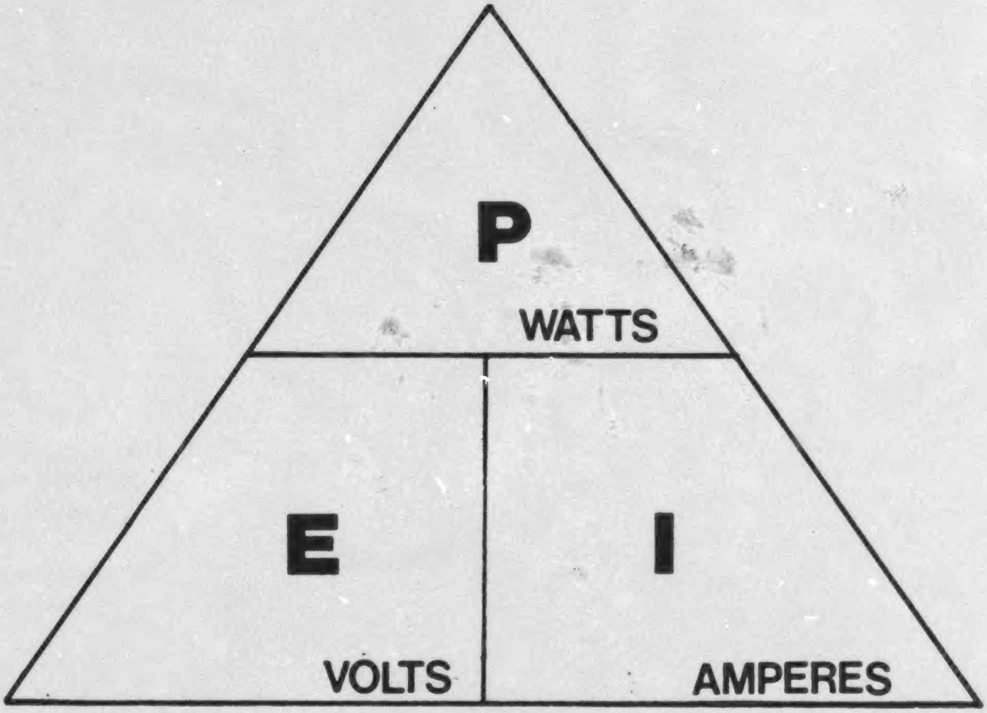
E	VOLTAGE	VOLTS
I	CURRENT	AMPERES
R	RESISTANCE	OHMS

$$E = I \cdot R$$

$$I = \frac{E}{R}$$

$$R = \frac{E}{I}$$

POWER · WATT'S LAW


P
WATTS
E
VOLTS
I
AMPERES

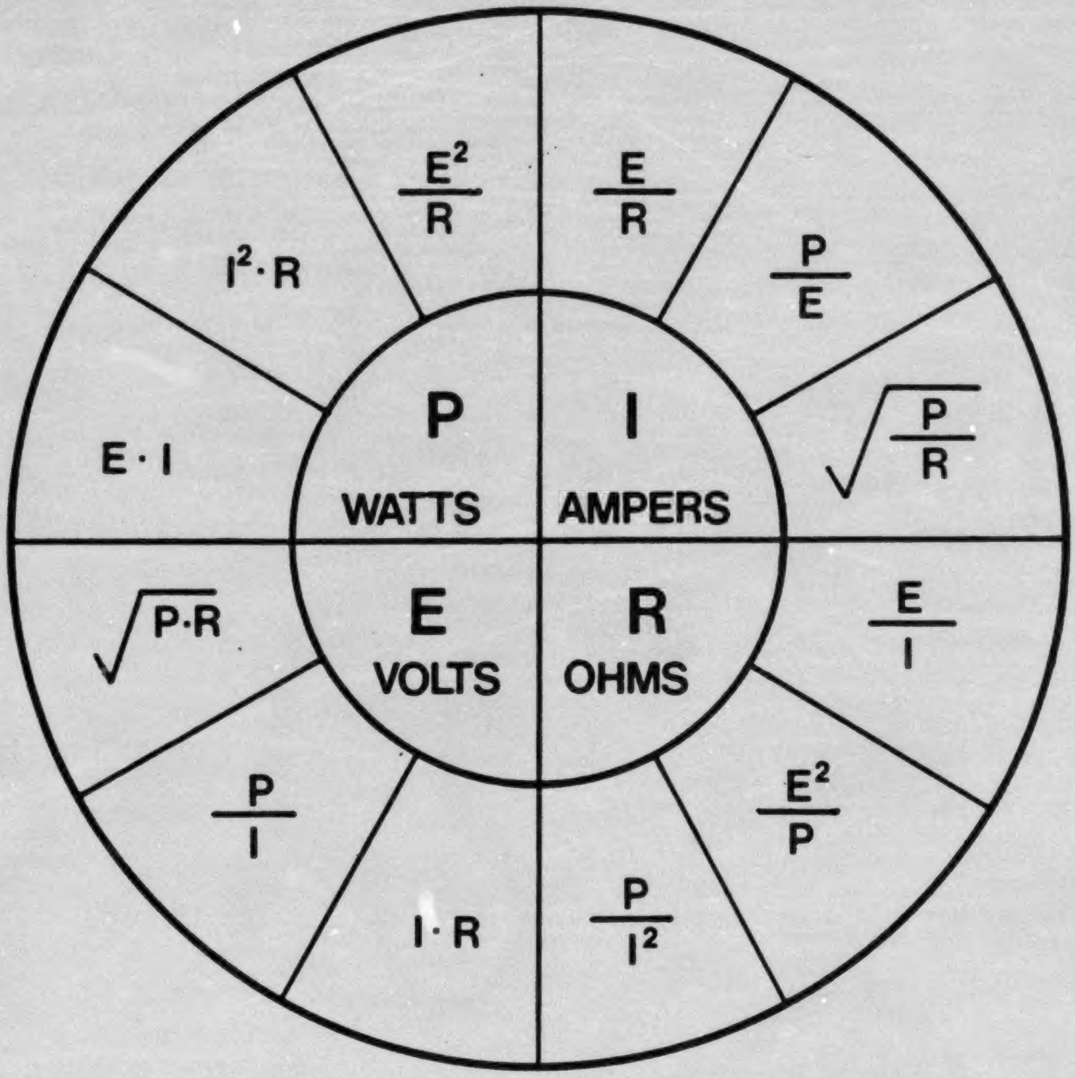
$E = I \cdot R$ $\quad I = \frac{E}{R}$ $\quad R = \frac{E}{I}$

$E = \frac{P}{I}$ $\quad I = \frac{P}{E}$ $\quad R = \frac{E^2}{P}$

$E = \sqrt{P \cdot R}$ $\quad I = \sqrt{\frac{P}{R}}$ $\quad R = \frac{P}{I^2}$

$P = E \cdot I$ $\quad P = I^2 \cdot R$ $\quad P = \frac{E^2}{R}$

OHM'S LAW & WATT'S LAW RELATIONSHIPS


P
WATTS
I
AMPERS
E
VOLTS
R
OHMS
$\frac{E}{R}$
$\frac{P}{E}$
$\sqrt{\frac{P}{R}}$
$\frac{E}{I}$
$\frac{E^2}{P}$
$\frac{P}{I^2}$
$I \cdot R$
$\frac{P}{I}$
$\sqrt{P \cdot R}$
$E \cdot I$
$I^2 \cdot R$
$\frac{E^2}{R}$

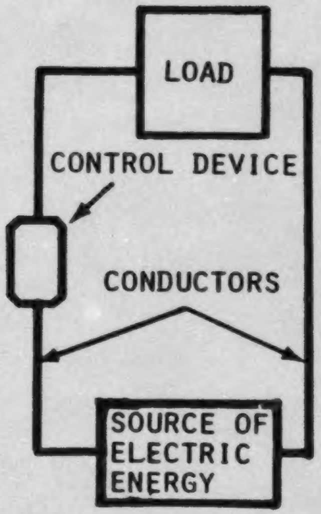
E = VOLTAGE

R = RESISTANCE

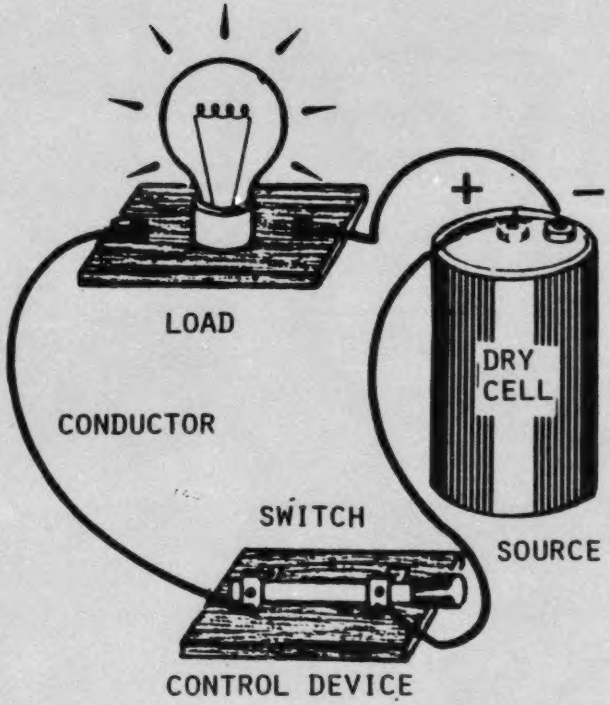
I = CURRENT

P = POWER

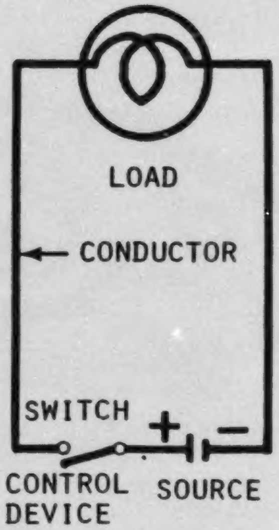
ELECTRIC CIRCUIT


LOAD
CONTROL DEVICE
CONDUCTORS
SOURCE OF ELECTRIC ENERGY

BLOCK DIAGRAM

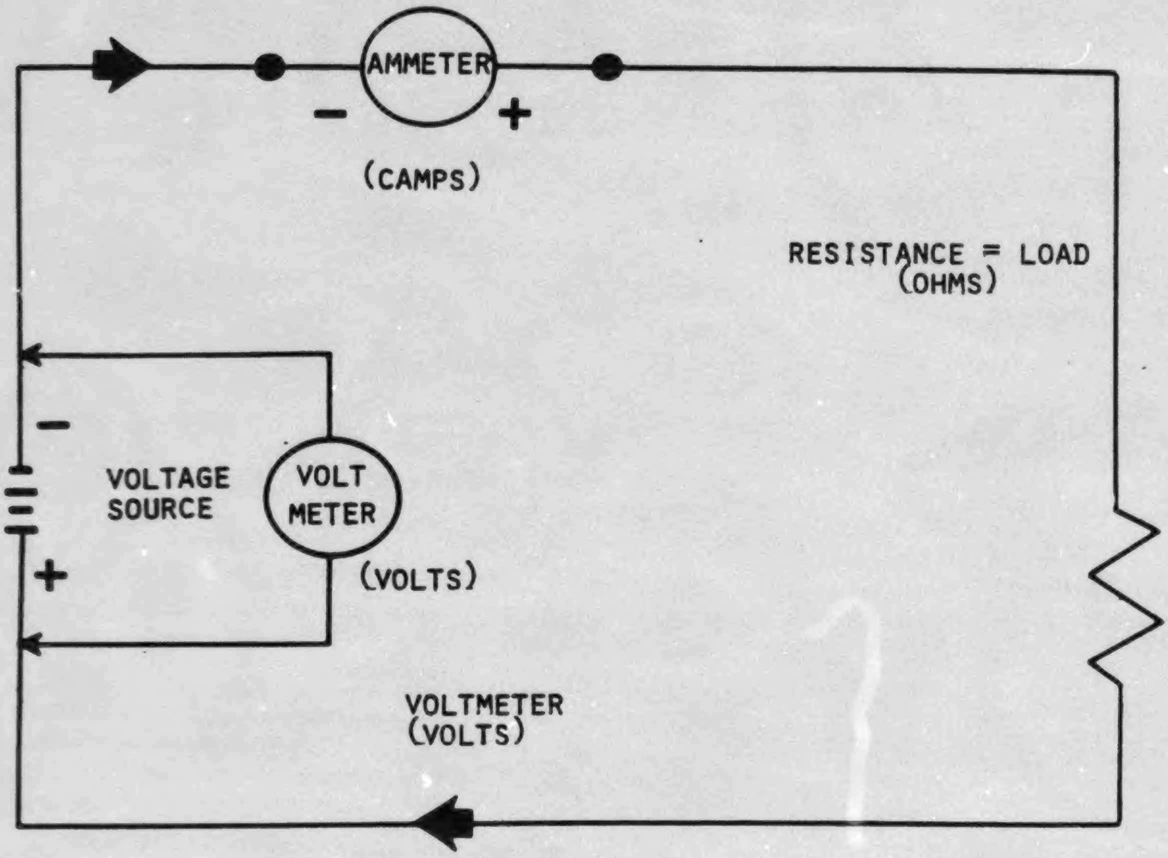

+
−
LOAD
DRY CELL
CONDUCTOR
SWITCH
SOURCE
CONTROL DEVICE

PICTORIAL DIAGRAM


LOAD
CONDUCTOR
SWITCH
+
−
CONTROL DEVICE
SOURCE

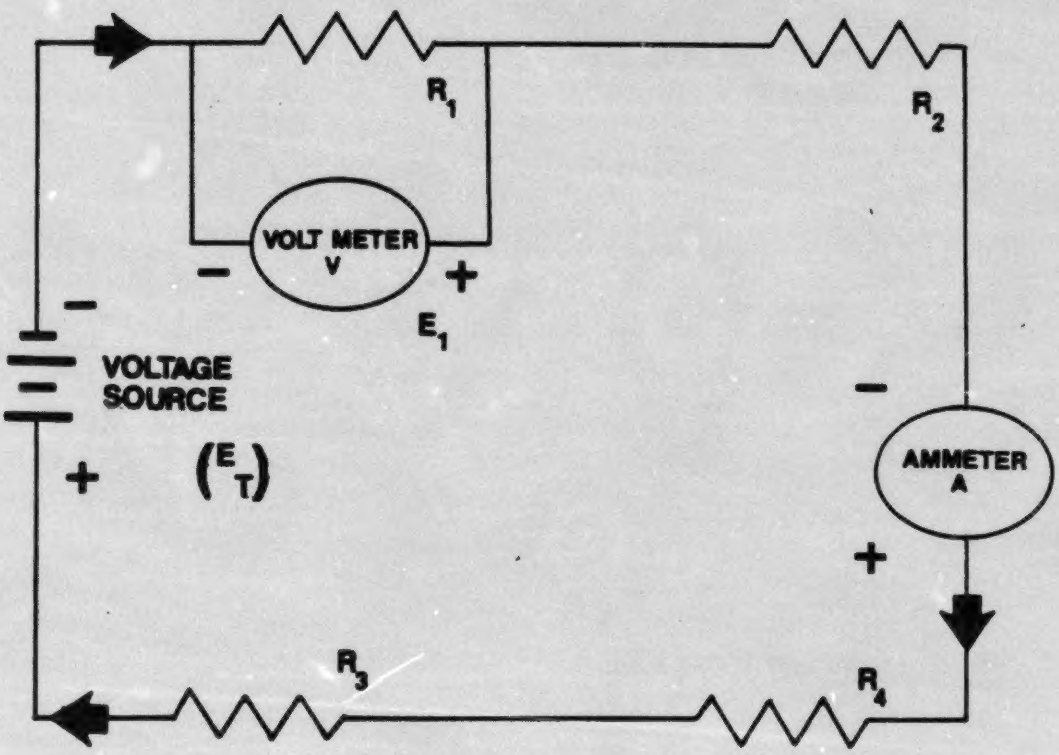
SCHEMATIC DIAGRAM

BASIC ELECTRICAL CIRCUIT


AMMETER
−
+
(CAMPS)
RESISTANCE = LOAD
(OHMS)
−
VOLTAGE
SOURCE
VOLT
METER
+
(VOLTS)
VOLTMETER
(VOLTS)

E	VOLTAGE (EMF)	VOLTS
I	CURRENT	AMPS
R	RESISTANCE	OHMS

SERIES CIRCUIT


R1
R2
VOLT METER
V
−
+
E1
−
VOLTAGE SOURCE
+
(ET)
−
AMMETER
A
+
I
R3
R4

$E_{TOTAL} = E_{R_1} + E_{R_2} + E_{R_3} + E_{R_4}$

$I_{TOTAL} = I_{R_1} = I_{R_2} = I_{R_3} = I_{R_4}$

$R_{TOTAL} = R_1 + R_2 + R_3 + R_4$

SERIES CIRCUITS

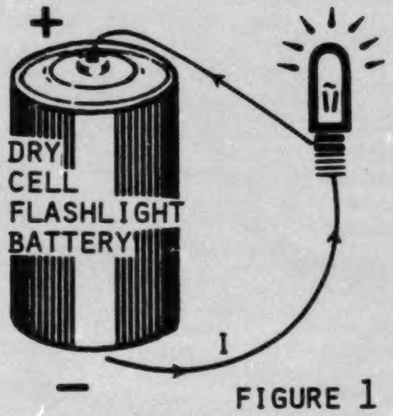

+
DRY
CELL
FLASHLIGHT
BATTERY
I
−

FIGURE 1

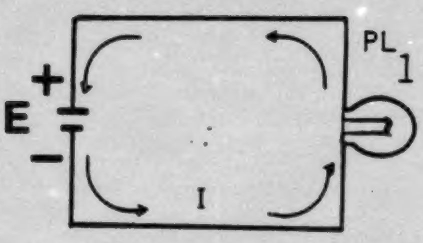


FIGURE 2

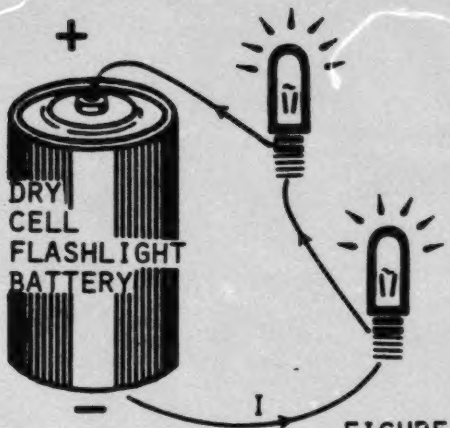

+
DRY
CELL
FLASHLIGHT
BATTERY
I
−

FIGURE 3

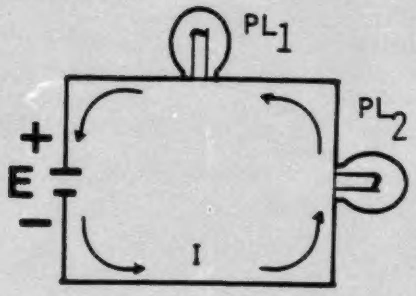


FIGURE 4

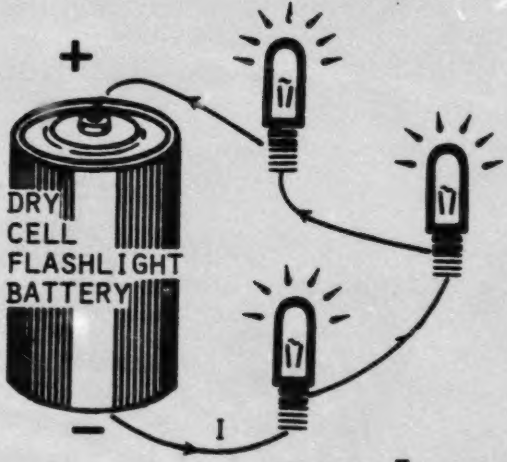

+
DRY
CELL
FLASHLIGHT
BATTERY
I
−

FIGURE 5

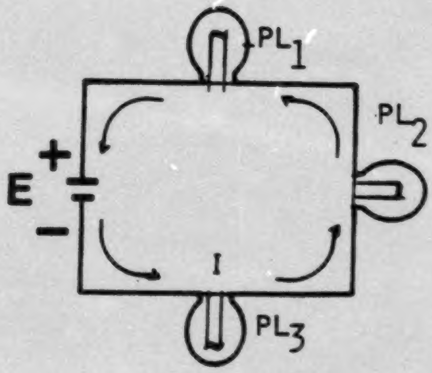
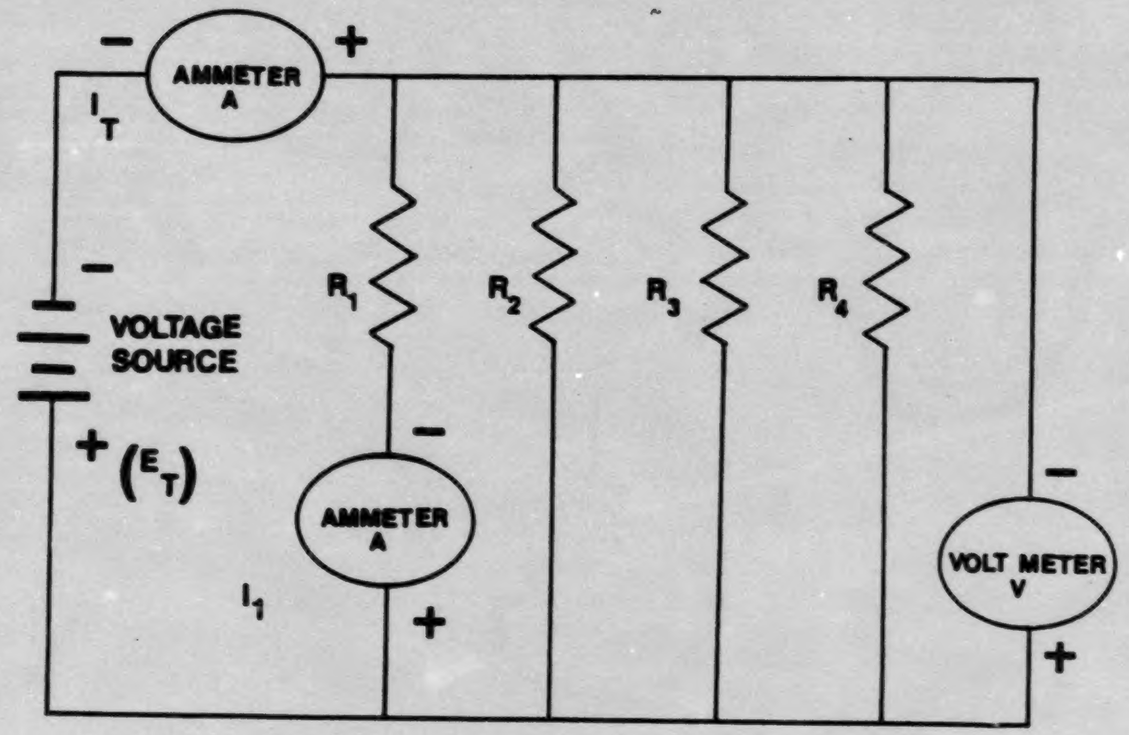

PL1
PL2
+
E
−
I
PL3

FIGURE 6

PARALLEL CIRCUIT



−
AMMETER
A
+
I T
−
VOLTAGE
SOURCE
+ (E T)
R1
R2
R3
R4
−
AMMETER
A
I1
+
−
VOLT METER
V
+

$$E_{TOTAL} = E_{R_1} = E_{R_2} = E_{R_3} = E_{R_3}$$

$$I_{TOTAL} = I_{R_1} + I_{R_2} + I_{R_3} + I_{R_4}$$

$$R_{TOTAL} = \frac{}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}}$$

PARALLEL CIRCUITS

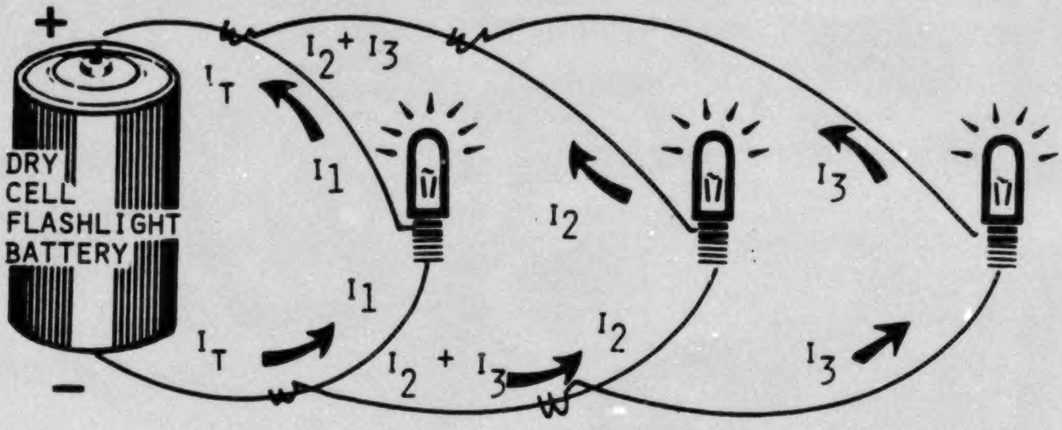

+
DRY CELL FLASHLIGHT BATTERY
−
I_T
I_1
$I_2 + I_3$
I_2
I_3
I_1
I_T
$I_2 + I_3$
I_2
I_3

FIGURE 1

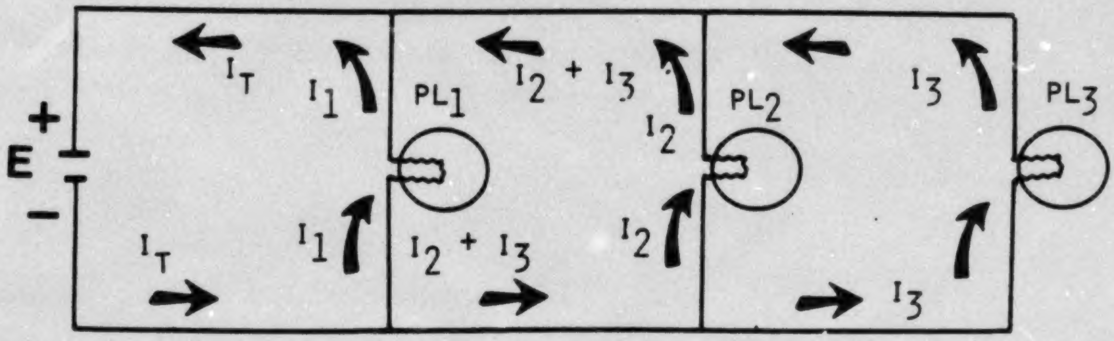
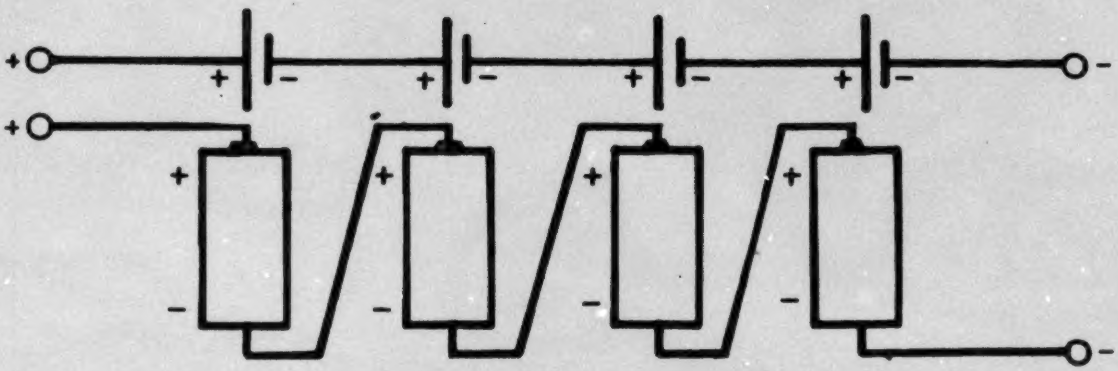
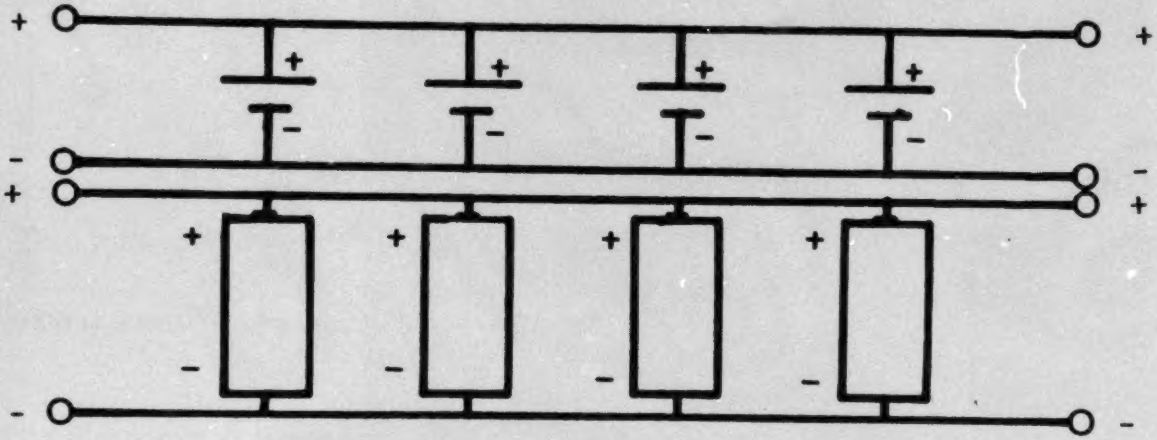

E
+
−
I_T
I_1
PL_1
$I_2 + I_3$
I_2
PL_2
I_3
PL_3
I_T
I_1
$I_2 + I_3$
I_2
I_3

FIGURE 2

CELLS IN SERIES & PARALLEL

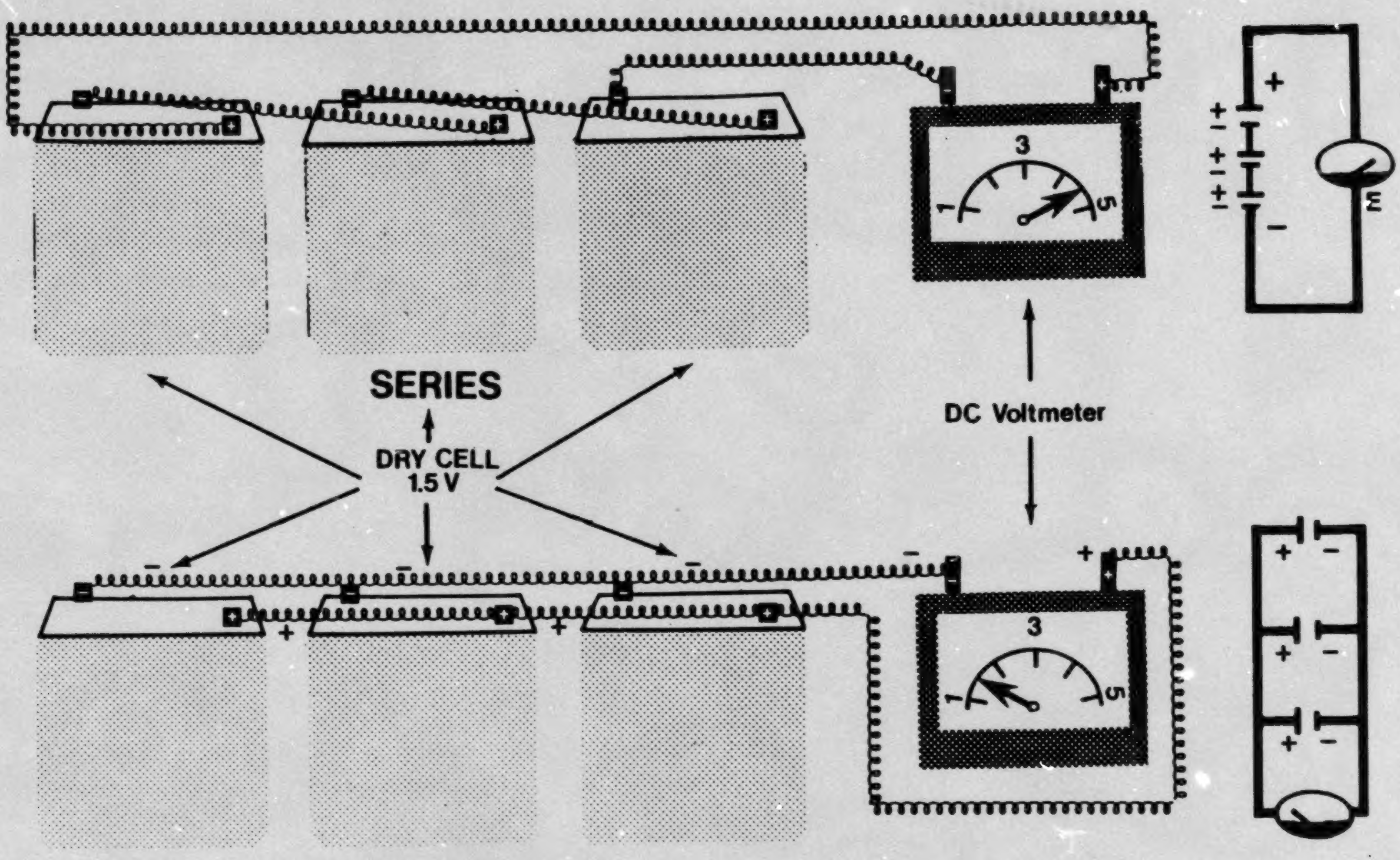


CELLS IN SERIES



CELLS IN PARALLEL

DRY CELL COMBINATIONS



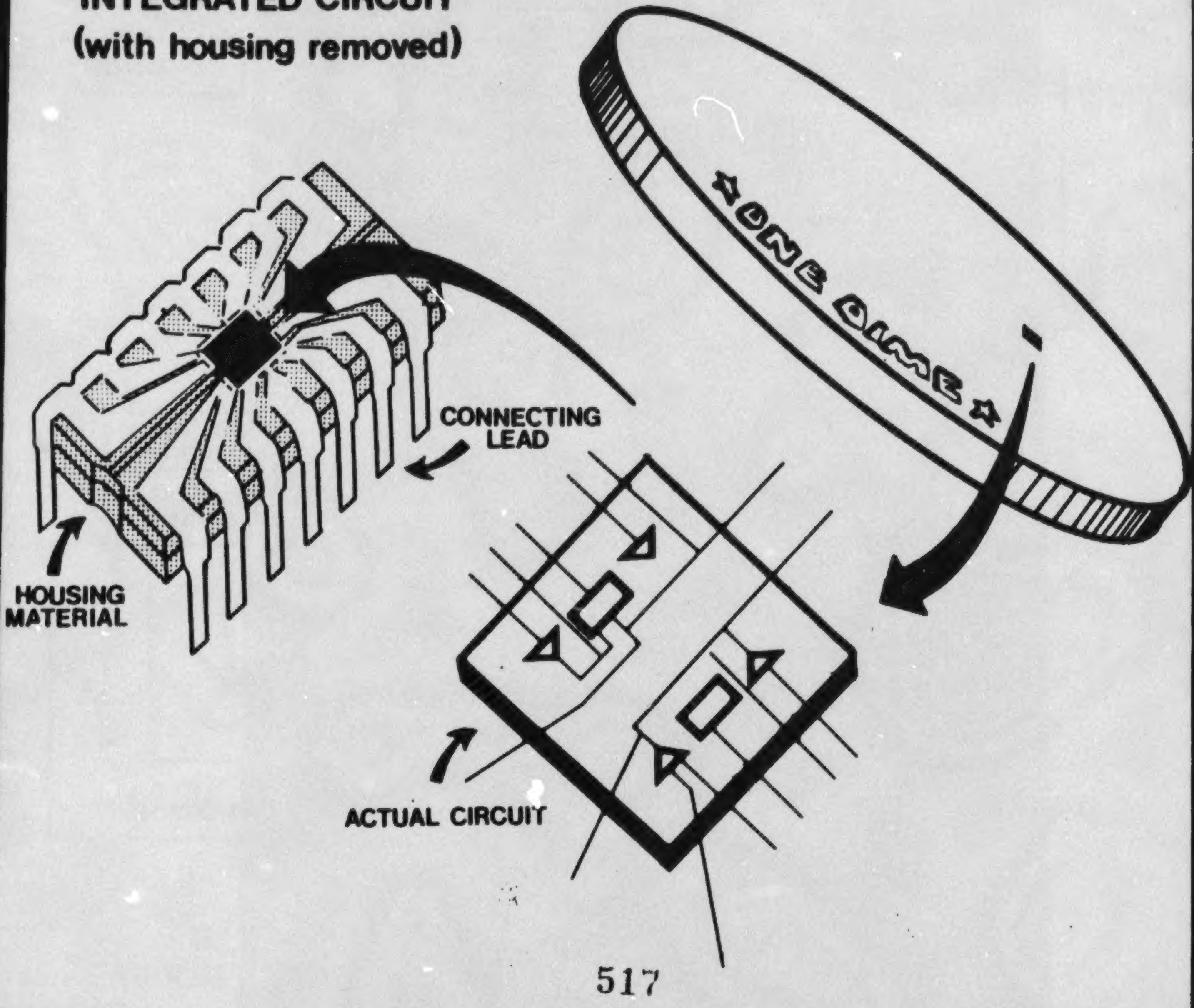
SERIES

DRY CELL
1.5 V

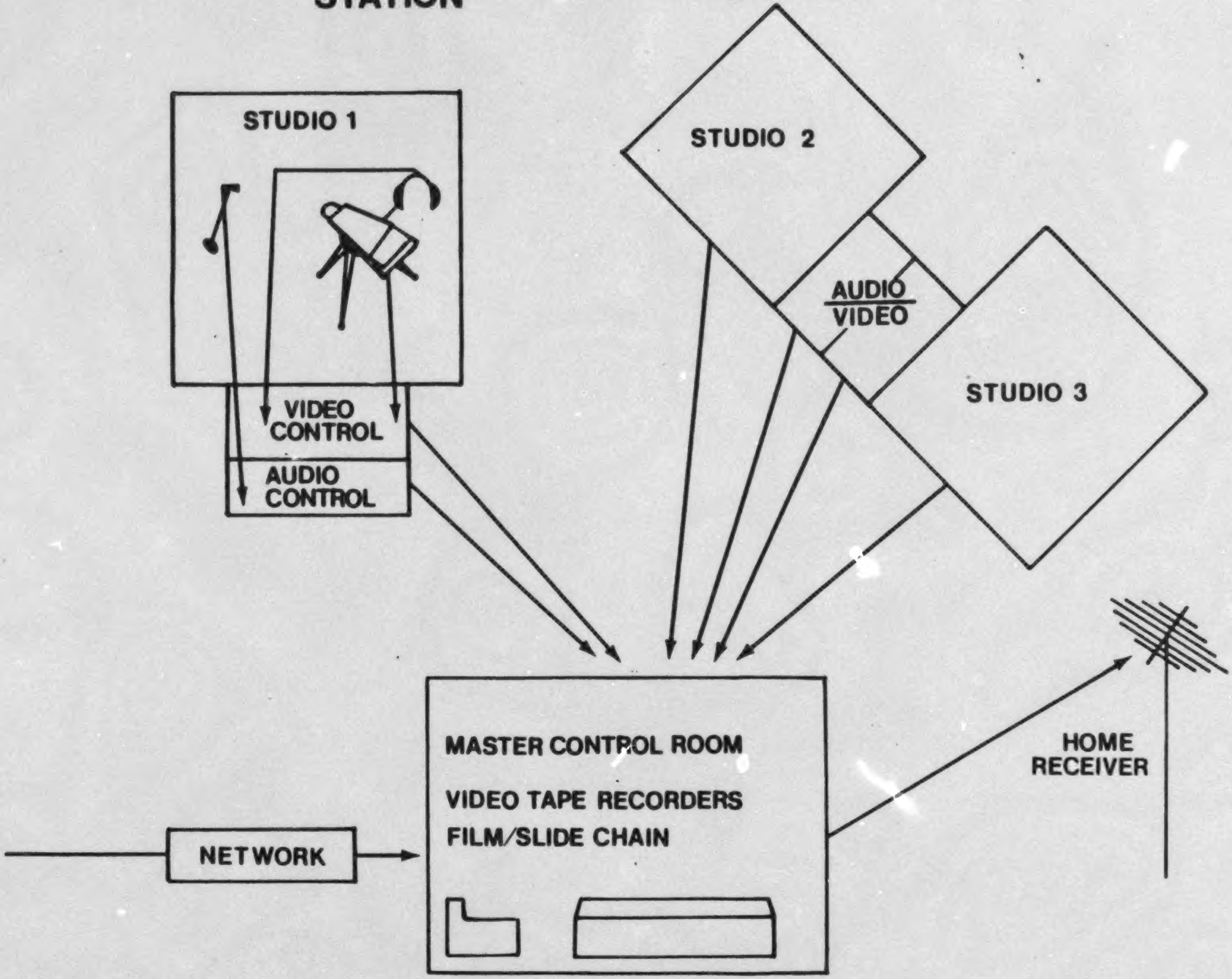
DC Voltmeter

PARALLEL

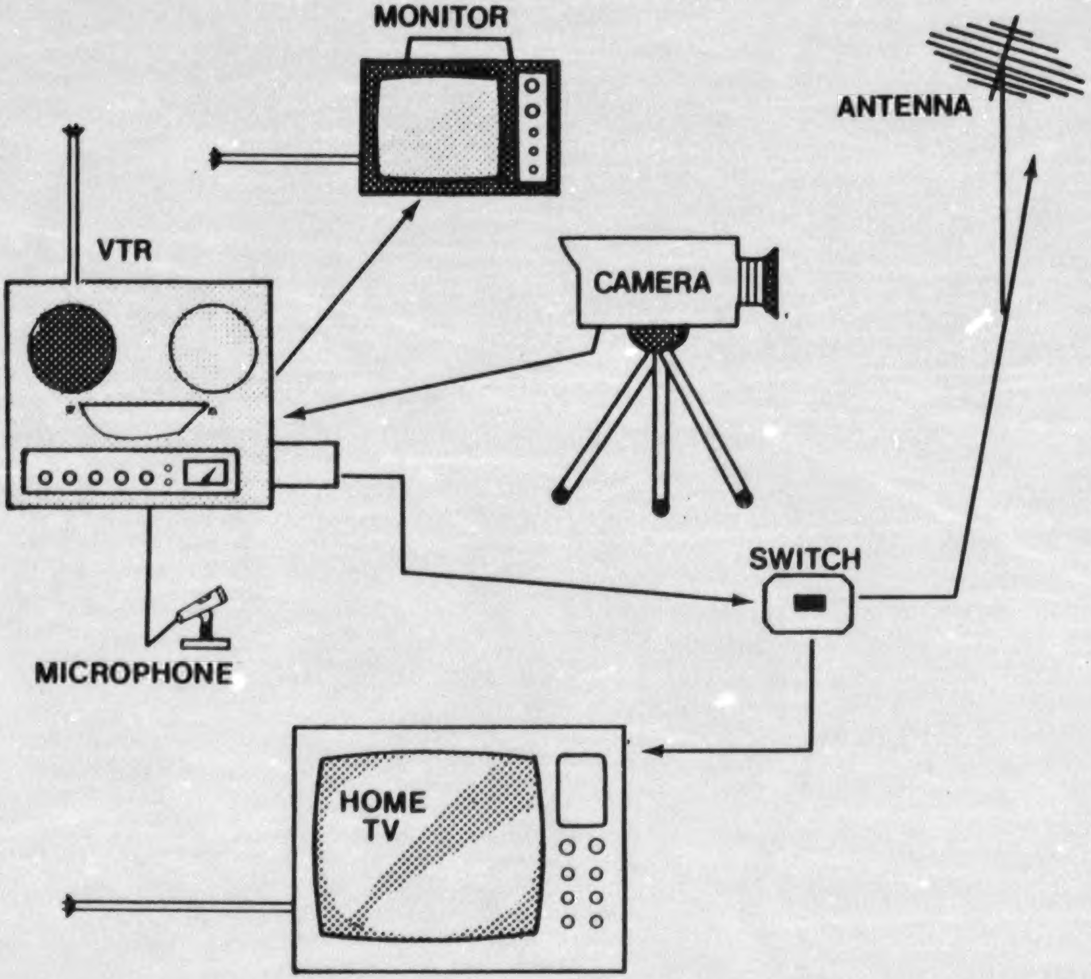
INTEGRATED CIRCUIT
(with housing removed)


CONNECTING LEAD
HOUSING MATERIAL
ACTUAL CIRCUIT
ONE DIME

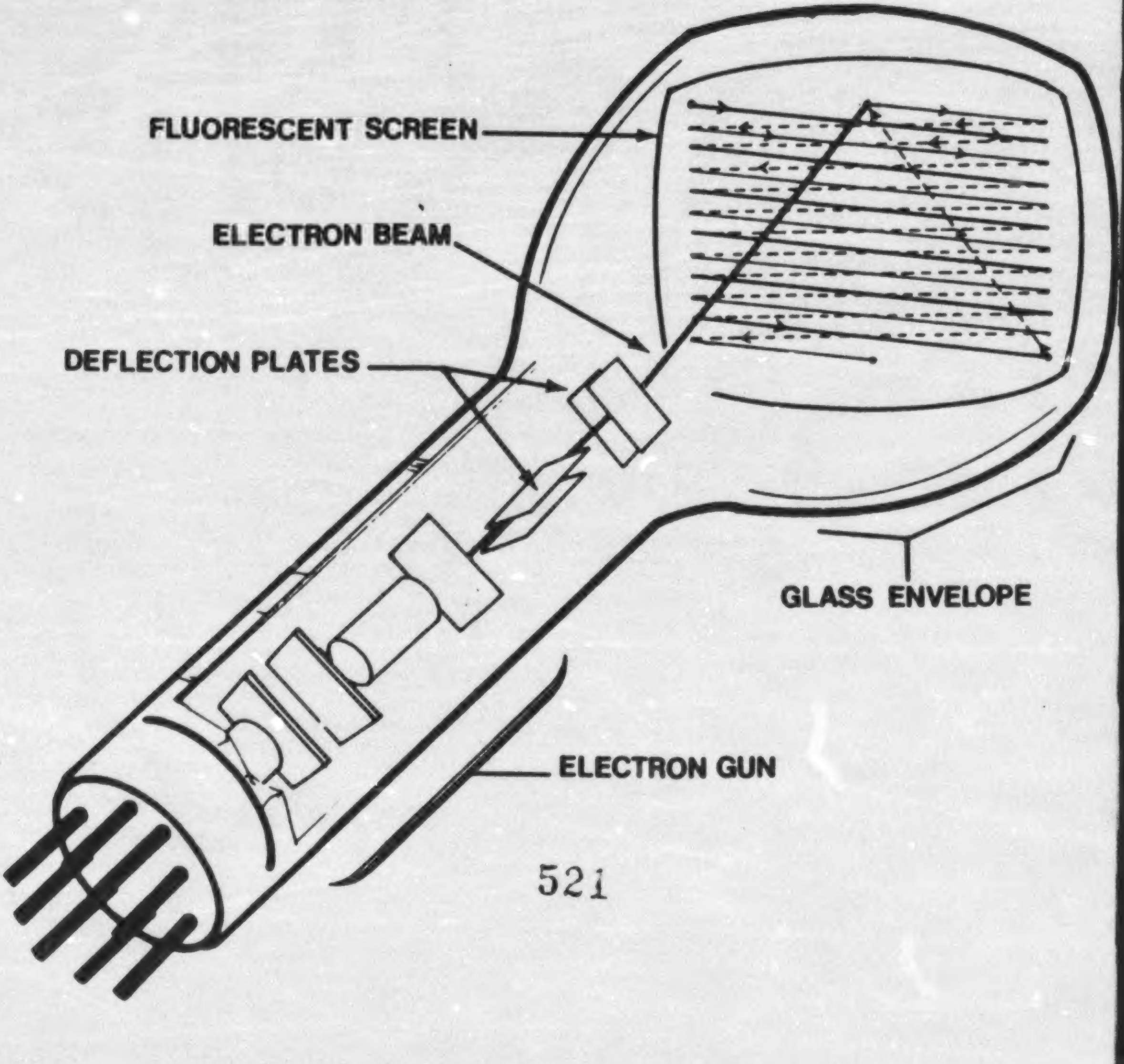
TELEVISION BROADCASTING STATION


STUDIO 1
VIDEO CONTROL
AUDIO CONTROL
STUDIO 2
AUDIO
VIDEO
STUDIO 3
MASTER CONTROL ROOM
VIDEO TAPE RECORDERS
FILM/SLIDE CHAIN
NETWORK
HOME RECEIVER

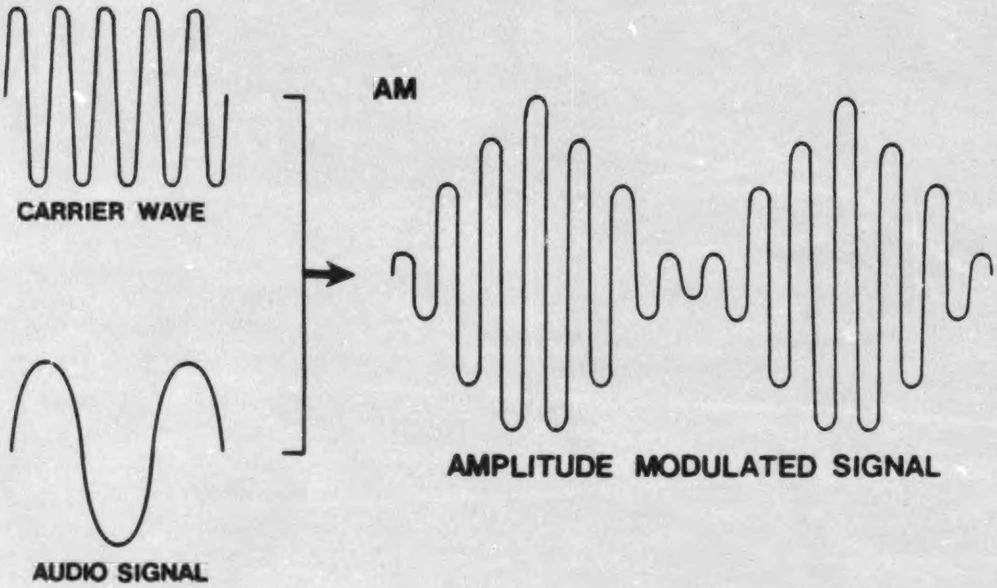
TYPICAL HOME CLOSED-CIRCUIT TELEVISION SYSTEM

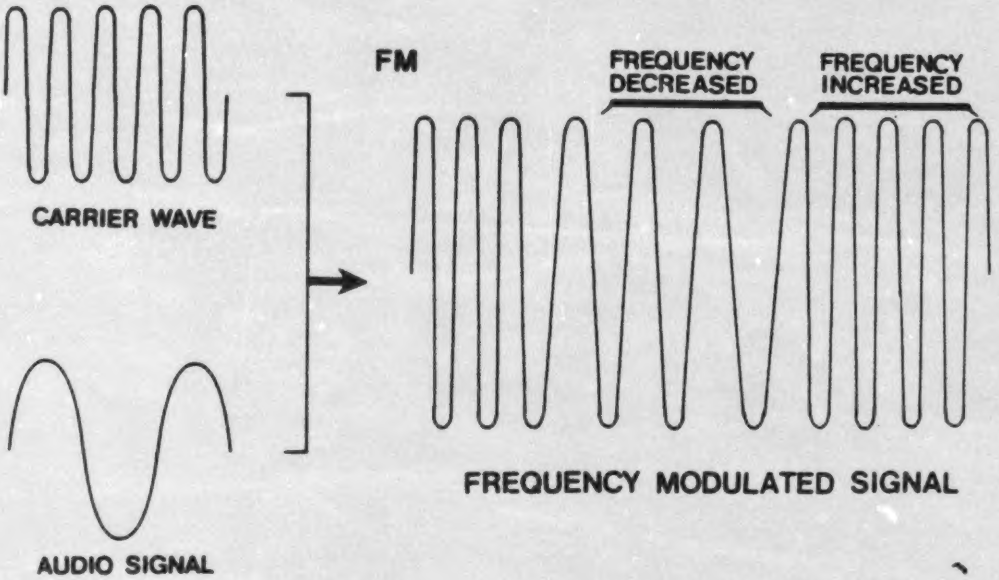

MONITOR
ANTENNA
VTR
CAMERA
SWITCH
MICROPHONE
HOME TV

CATHODE-RAY TUBE

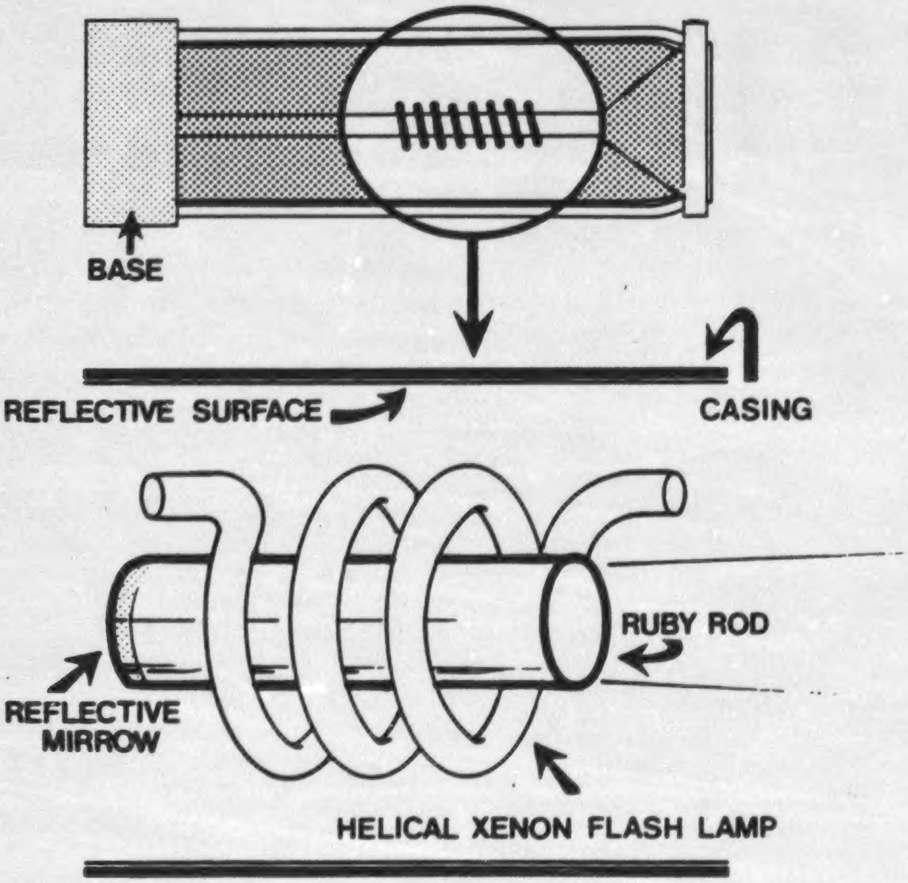

FLUORESCENT SCREEN
ELECTRON BEAM
DEFLECTION PLATES
GLASS ENVELOPE
ELECTRON GUN

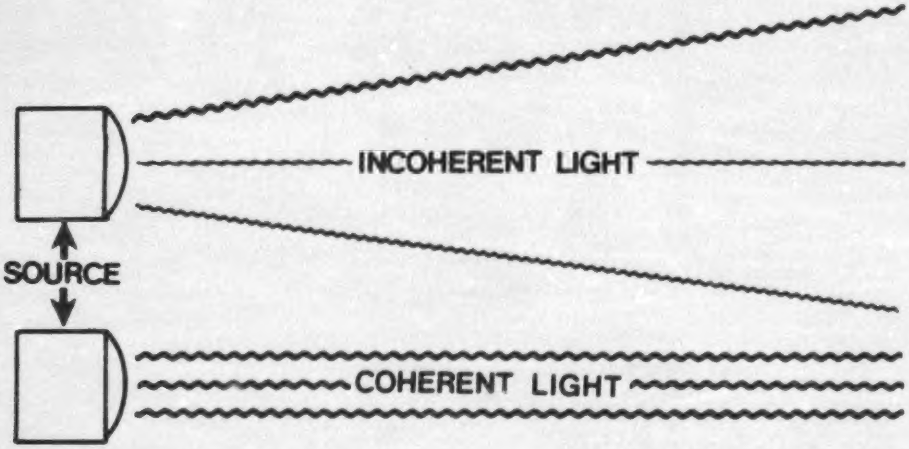
MODULATION


CARRIER WAVE
AUDIO SIGNAL
AM
AMPLITUDE MODULATED SIGNAL

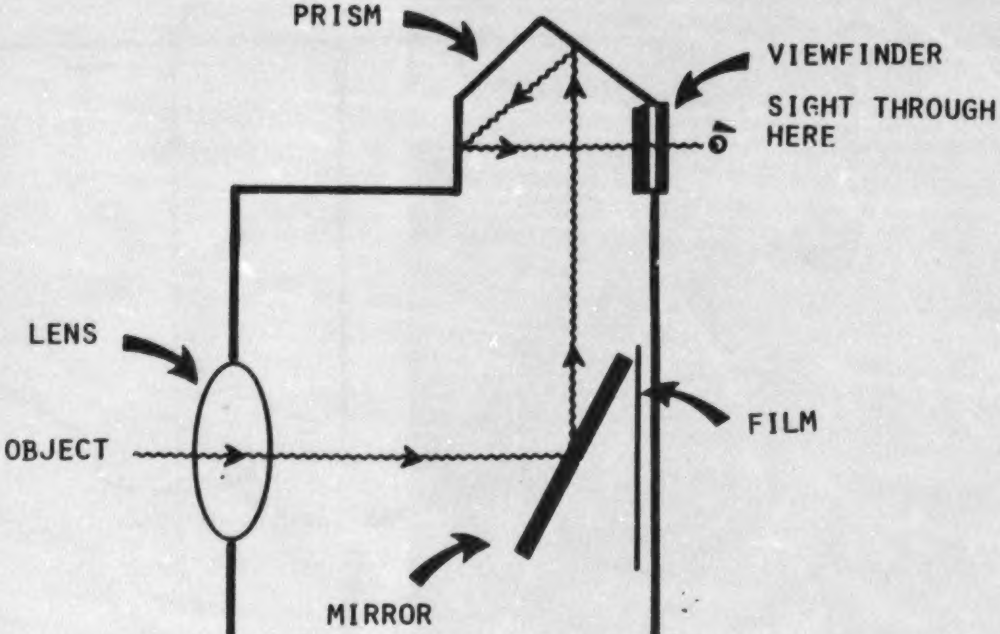

CARRIER WAVE
AUDIO SIGNAL
FM
FREQUENCY DECREASED
FREQUENCY INCREASED
FREQUENCY MODULATED SIGNAL

LASER

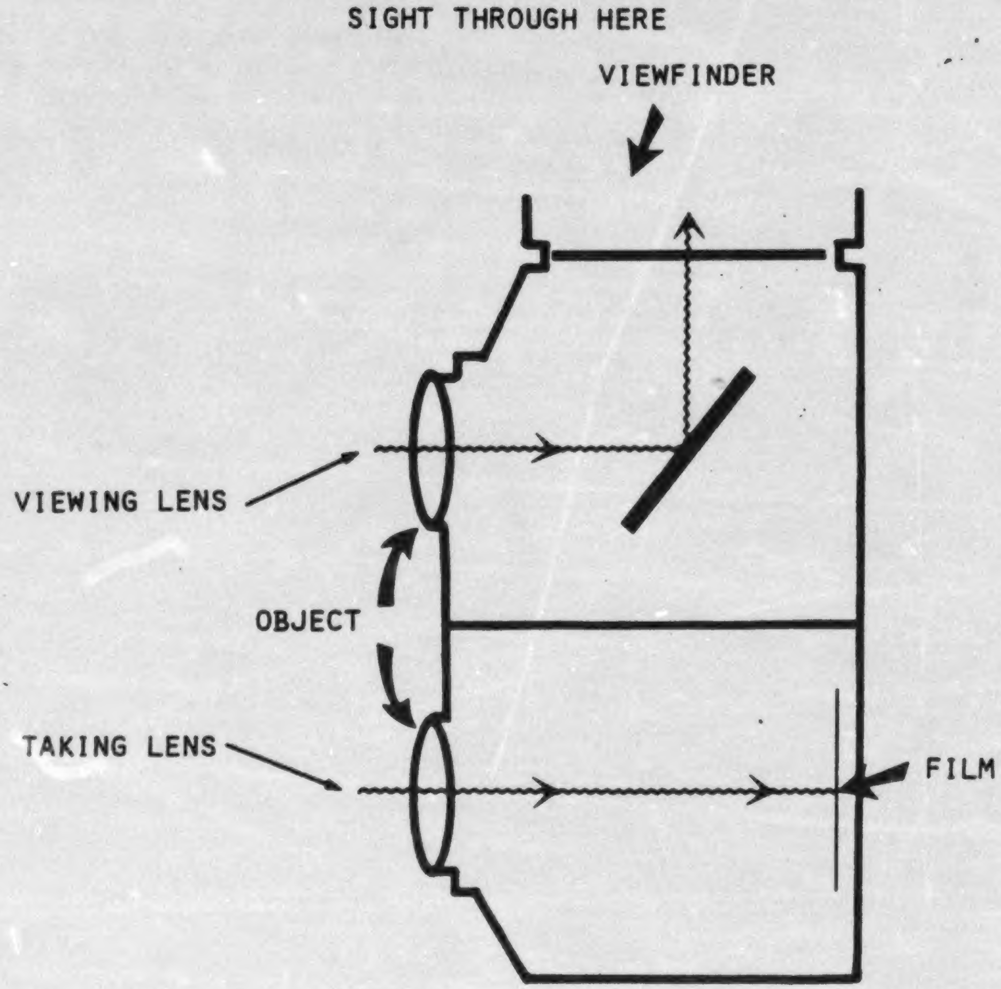

BASE
REFLECTIVE SURFACE
CASING
RUBY ROD
REFLECTIVE MIRROW
HELICAL XENON FLASH LAMP


INCOHERENT LIGHT
SOURCE
COHERENT LIGHT

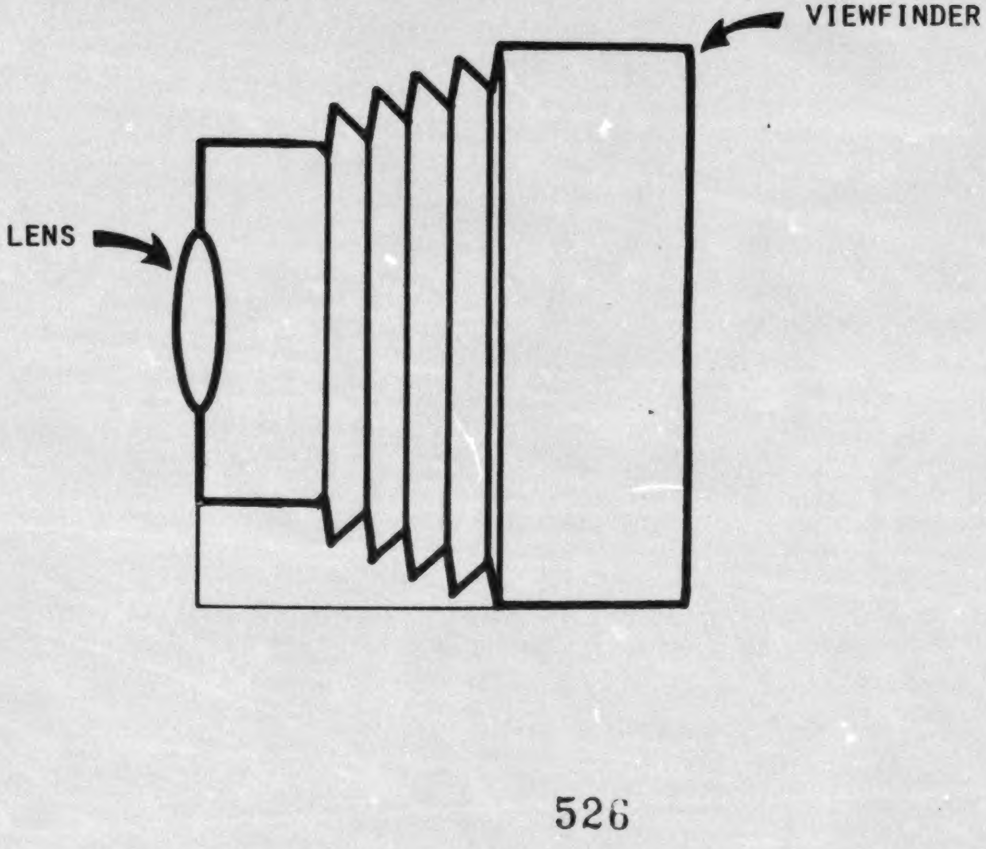
SINGLE LENS REFLEX


PRISM
VIEWFINDER
SIGHT THROUGH HERE
LENS
OBJECT
FILM
MIRROR

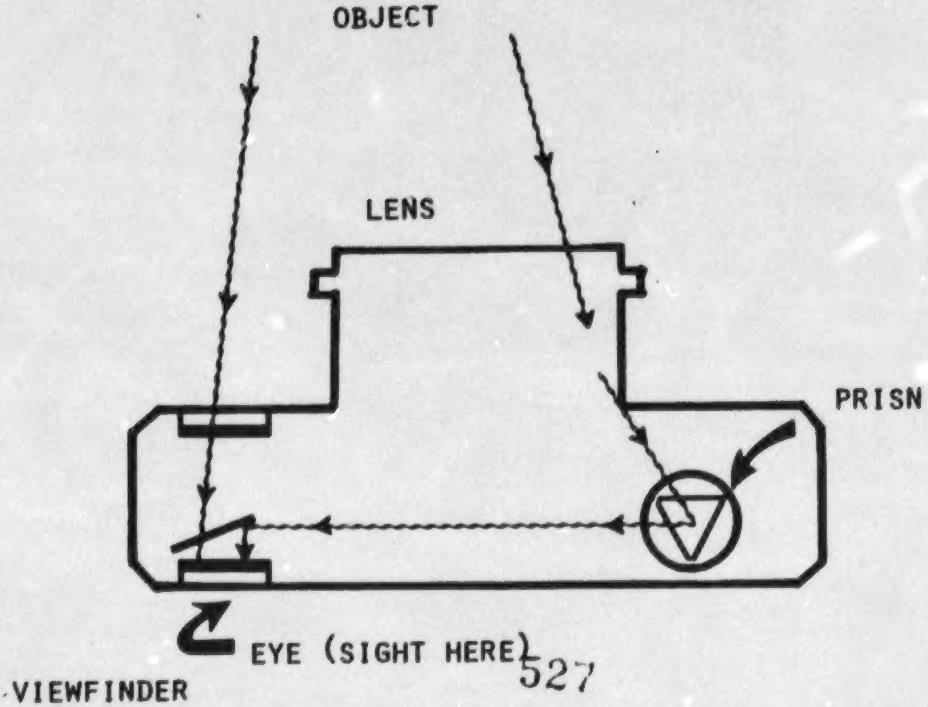
TWIN LENS REFLEX


SIGHT THROUGH HERE
VIEWFINDER
VIEWING LENS
OBJECT
TAKING LENS
FILM

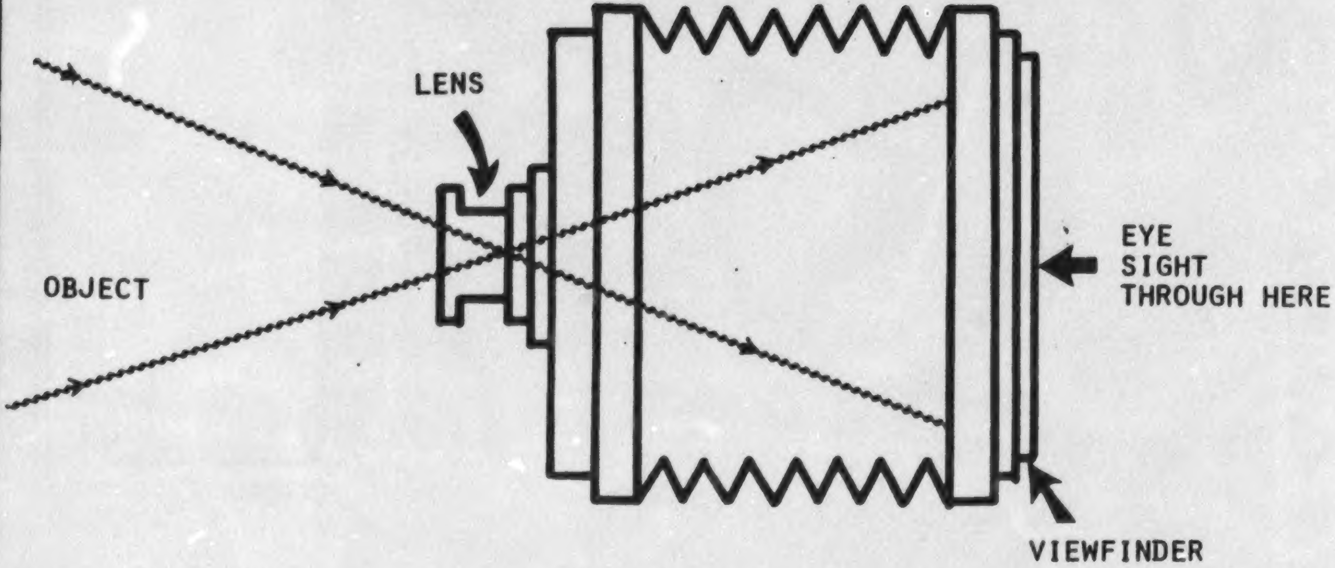
BELLOWS CAMERA


VIEWFINDER
LENS

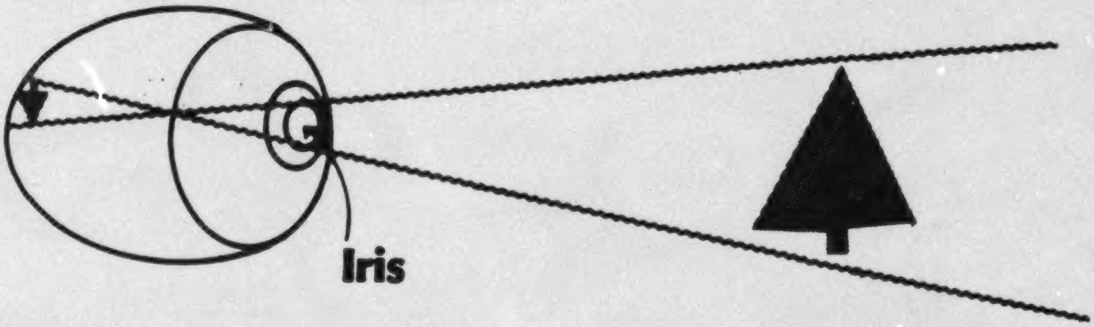
RANGEFINDER CAMERA

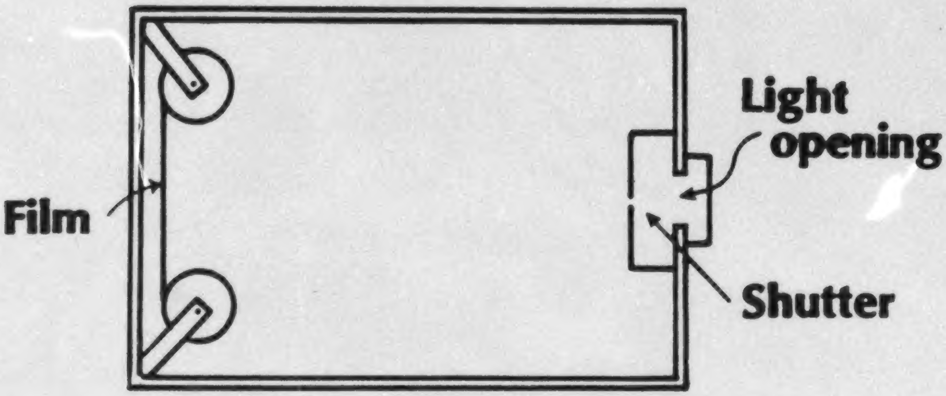

OBJECT
LENS
PRISN
EYE (SIGHT HERE)
VIEWFINDER

VIEW CAMERA


LENS
OBJECT
EYE
SIGHT
THROUGH HERE
VIEWFINDER

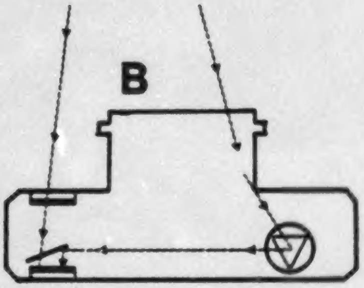
EYE-CAMERA COMPARISON



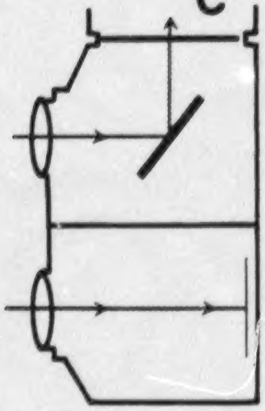

Light
opening
Film
Shutter

Light tight box

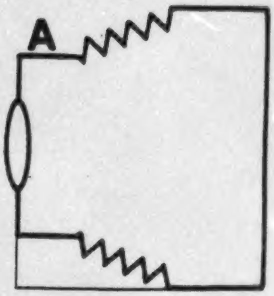
B



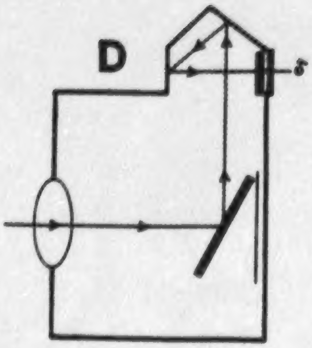
C



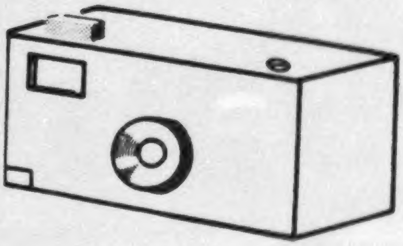
A



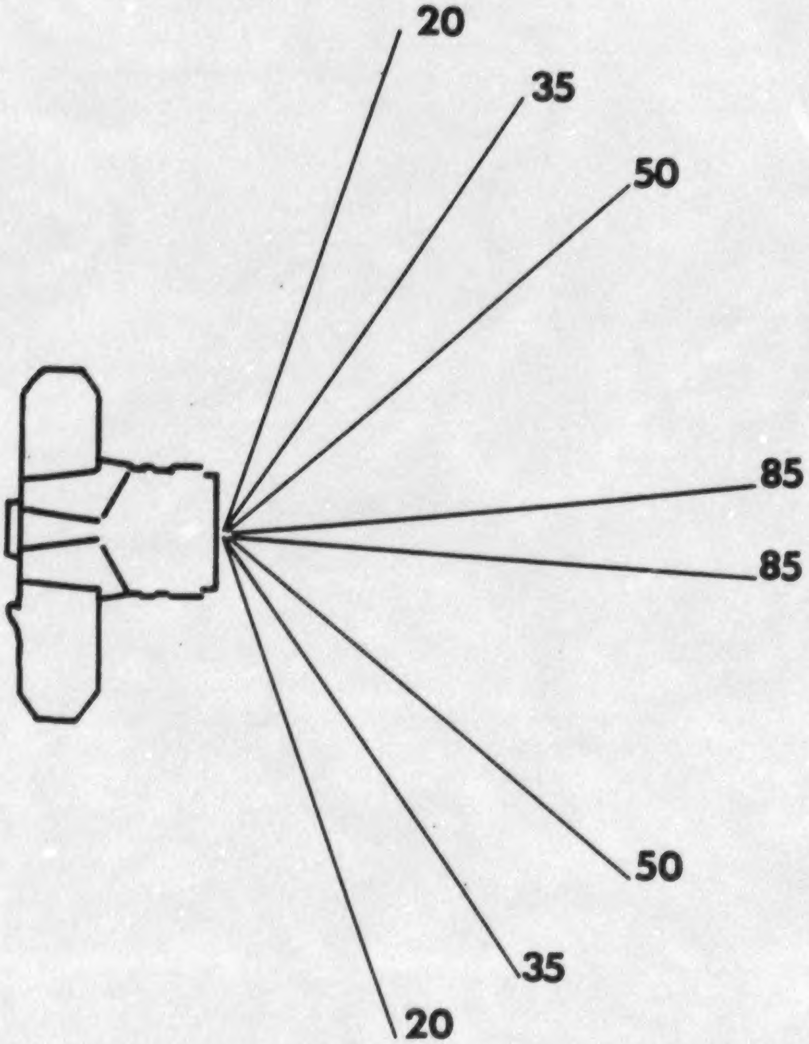
D



E

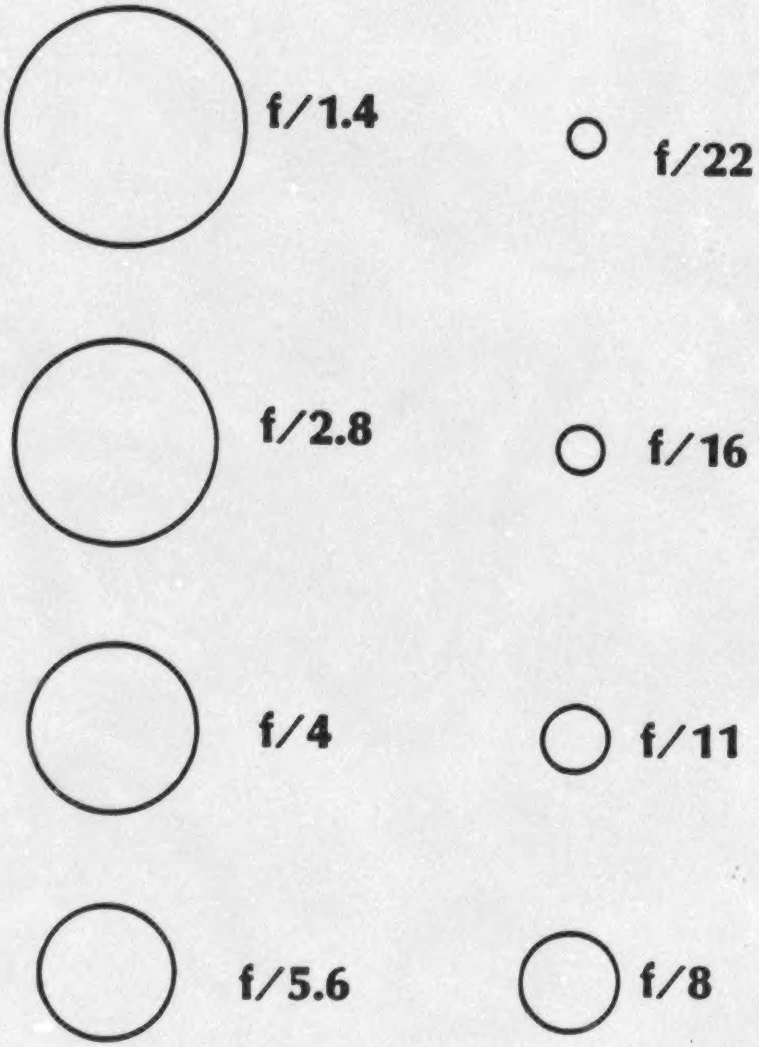


VIEWING ANGLES


20
35
50
85
85
50
35
20

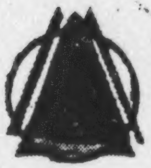
LENS OPENING SIZES

f/STOP OPENINGS

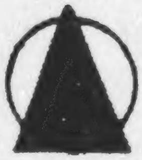

f/1.4
f/22
f/2.8
f/16
f/4
f/11
f/5.6
f/8

Focusing Screens

COINCIDENT

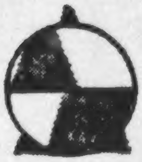


out of focus

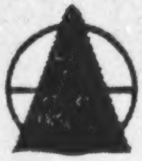


in focus

SPLIT IMAGE



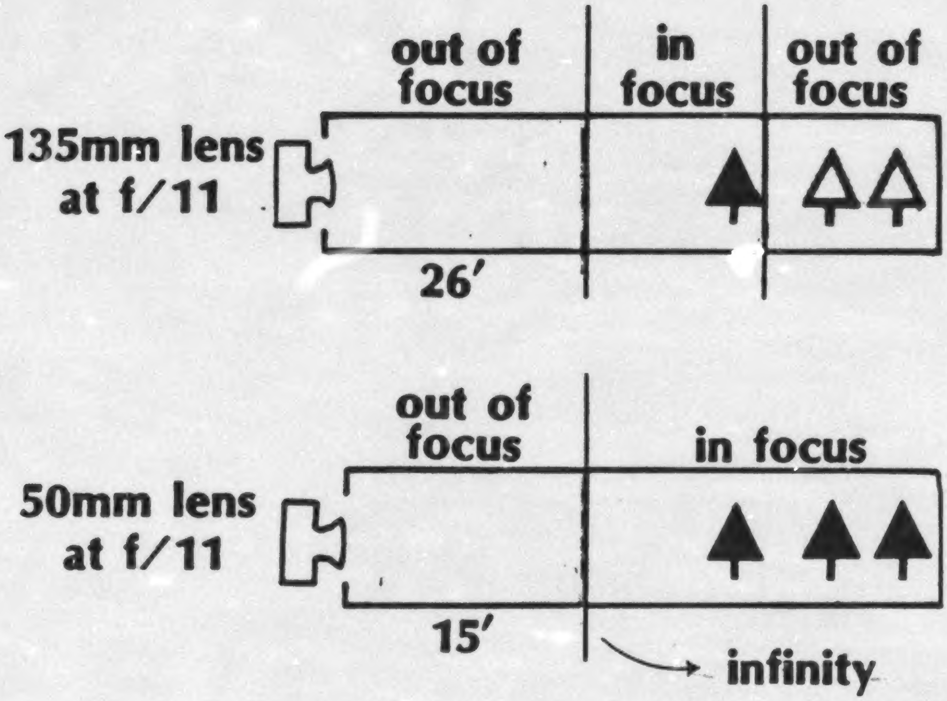
out of focus



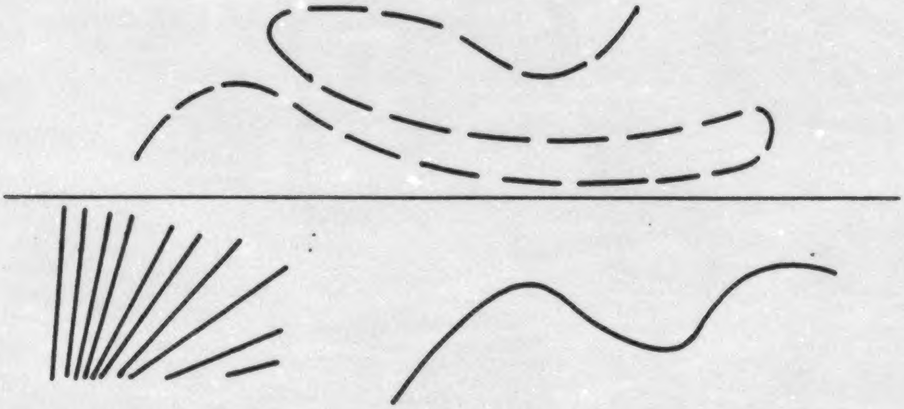
in focus

DEPTH OF FIELD

CAMERA FOCUSED AT 30 FEET


out of focus
in focus
out of focus
135mm lens at f/11
26′
out of focus
in focus
50mm lens at f/11
15′
infinity

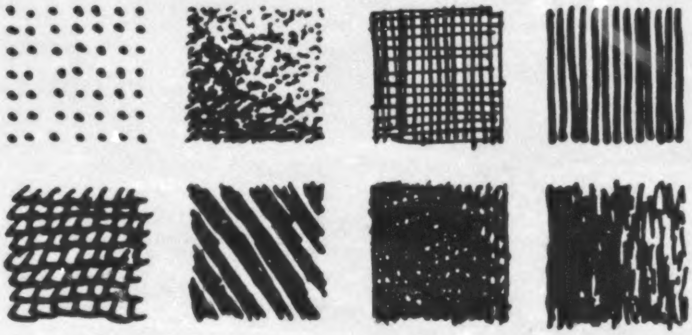
ELEMENTS OF DESIGN



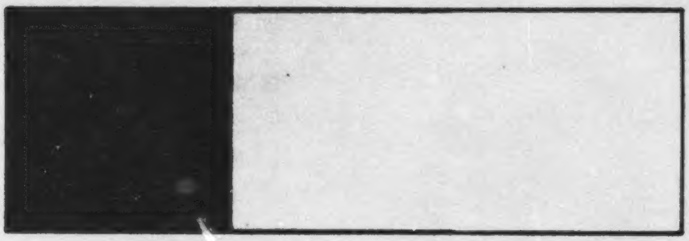
LINES MAY GIVE YOU THE FEELING OF MOVING FAST OR SLOW. THEY MIGHT BE STATIC OR DYNAMIC. LINES CREATE ENERGY AND DIRECTION.

TEXTURE:

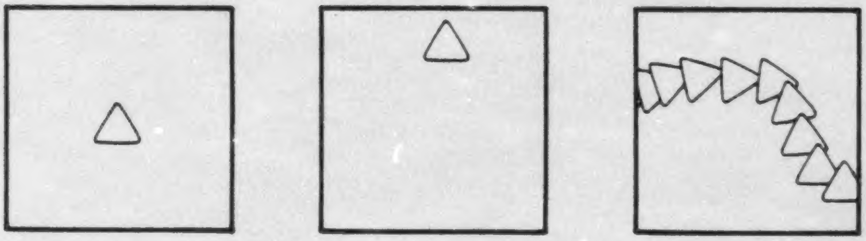
OBJECTS WITH A ROUGH SURFACE.



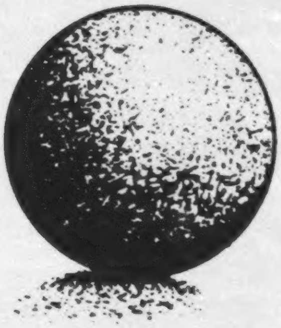
1. VALUE SCALE



VALUE CHANGES WILL HELP CREATE
DEPTH IN A PICTURE.

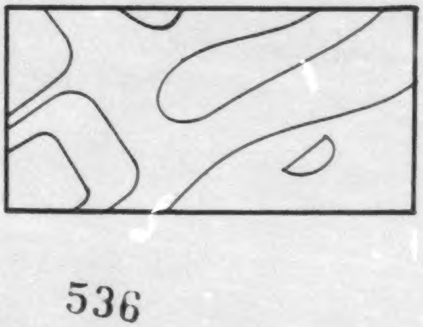


2. SPACE AS OBJECTS ADVANCE
AN RECEED.

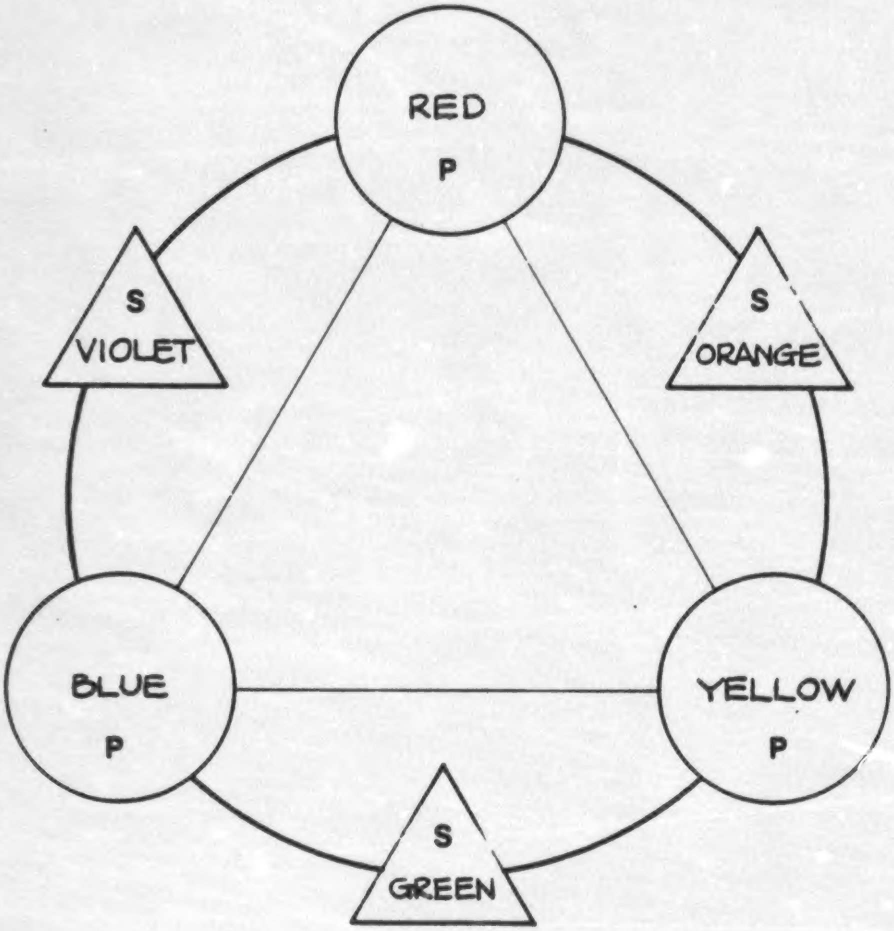


3. VOLUME, MASS
OR 3-DIMENSION

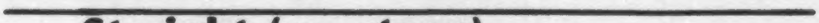
4. SHAPE AREA
OR 2-DIMENSION



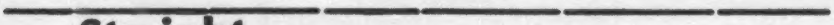
5. COLOR WHEEL WITH PRIMARY & SECONDARY COLORS.


RED
P
S
VIOLET
S
ORANGE
BLUE
P
YELLOW
P
S
GREEN

SKETCHING

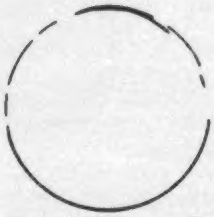


Straight (no stops)

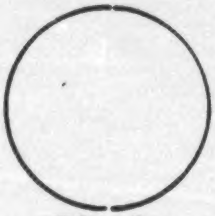


Straight

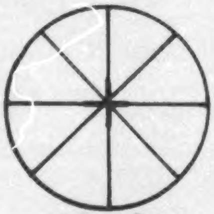
Done by drawing one section , moving hand to right, adjoining as close as possible gives the appearance of one line.



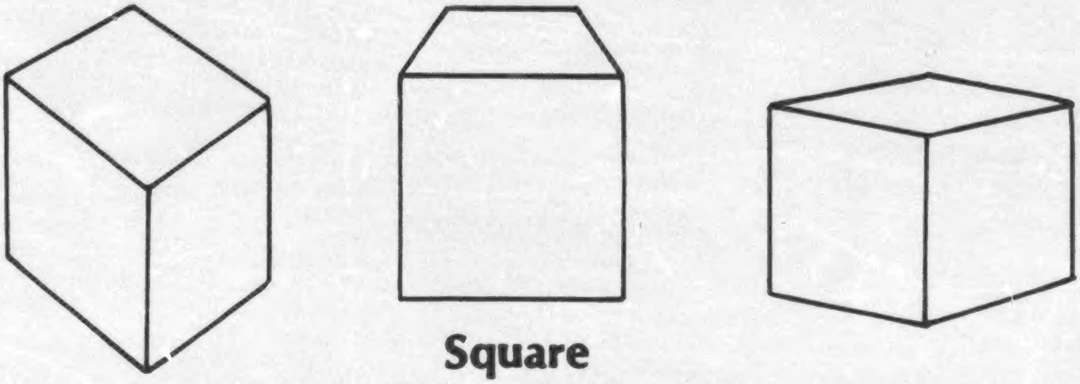
Freehand circle



Circle (2 arcs)

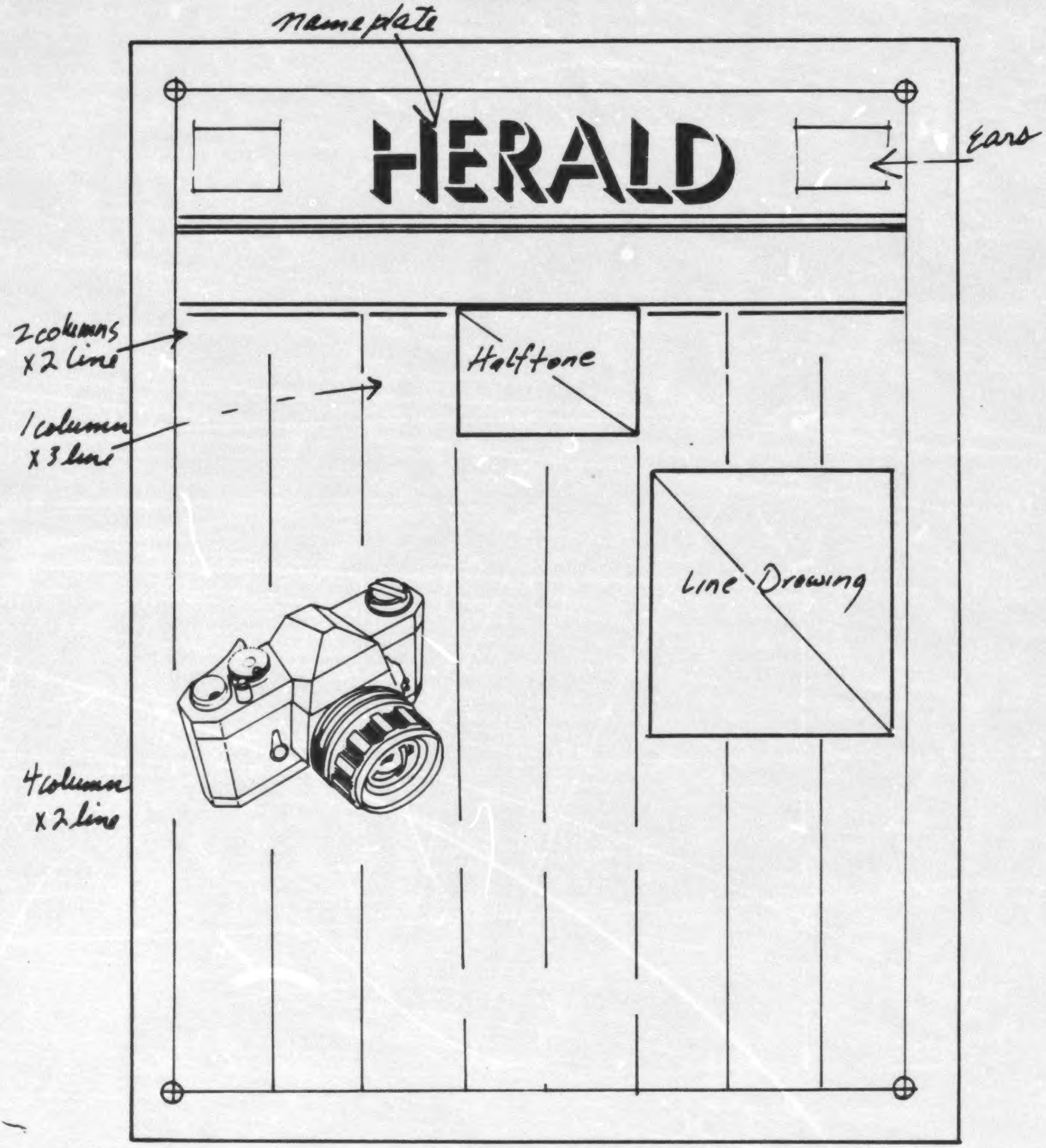


Circle equal lines

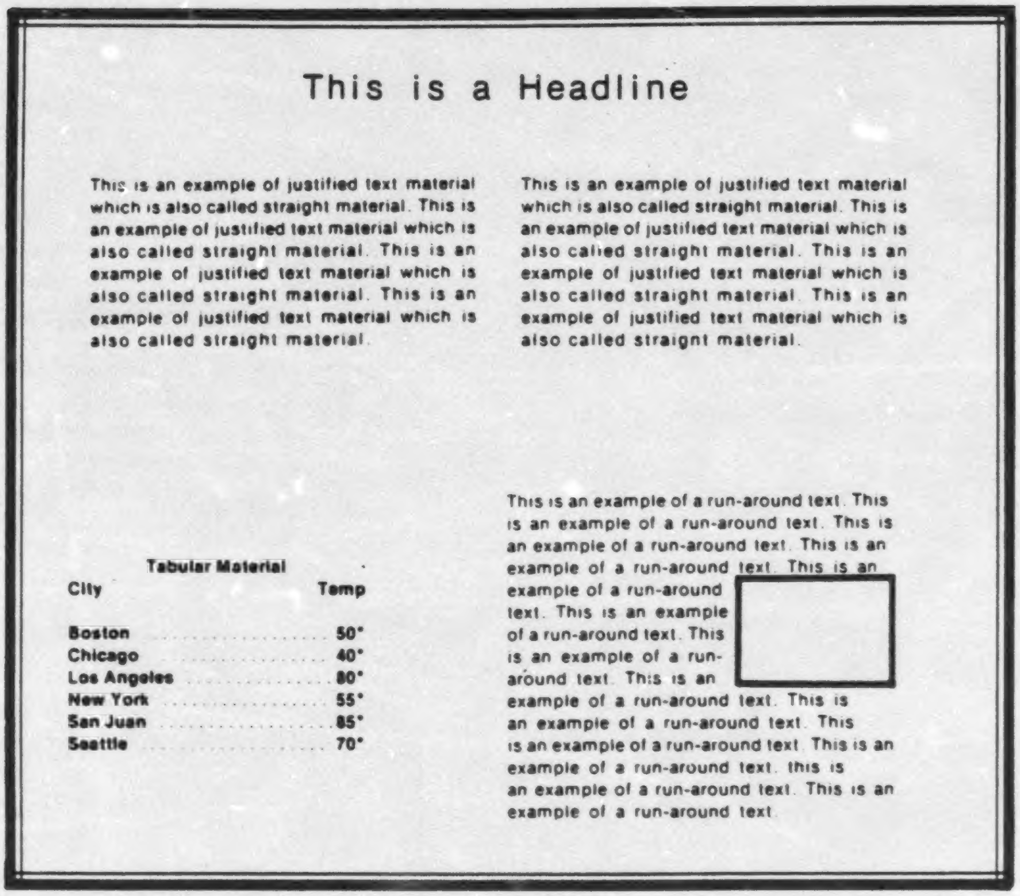


Square 3 different views

PLANNING A LAYOUT


nameplate
HERALD
Ears
2 columns
x 2 line
Halftone
1 column
x 3 line
Line Drawing
4 column
x 2 line

LAYOUT



This is a Headline

This is an example of justified text material which is also called straight material. This is an example of justified text material which is also called straight material. This is an example of justified text material which is also called straight material. This is an example of justified text material which is also called straight material.

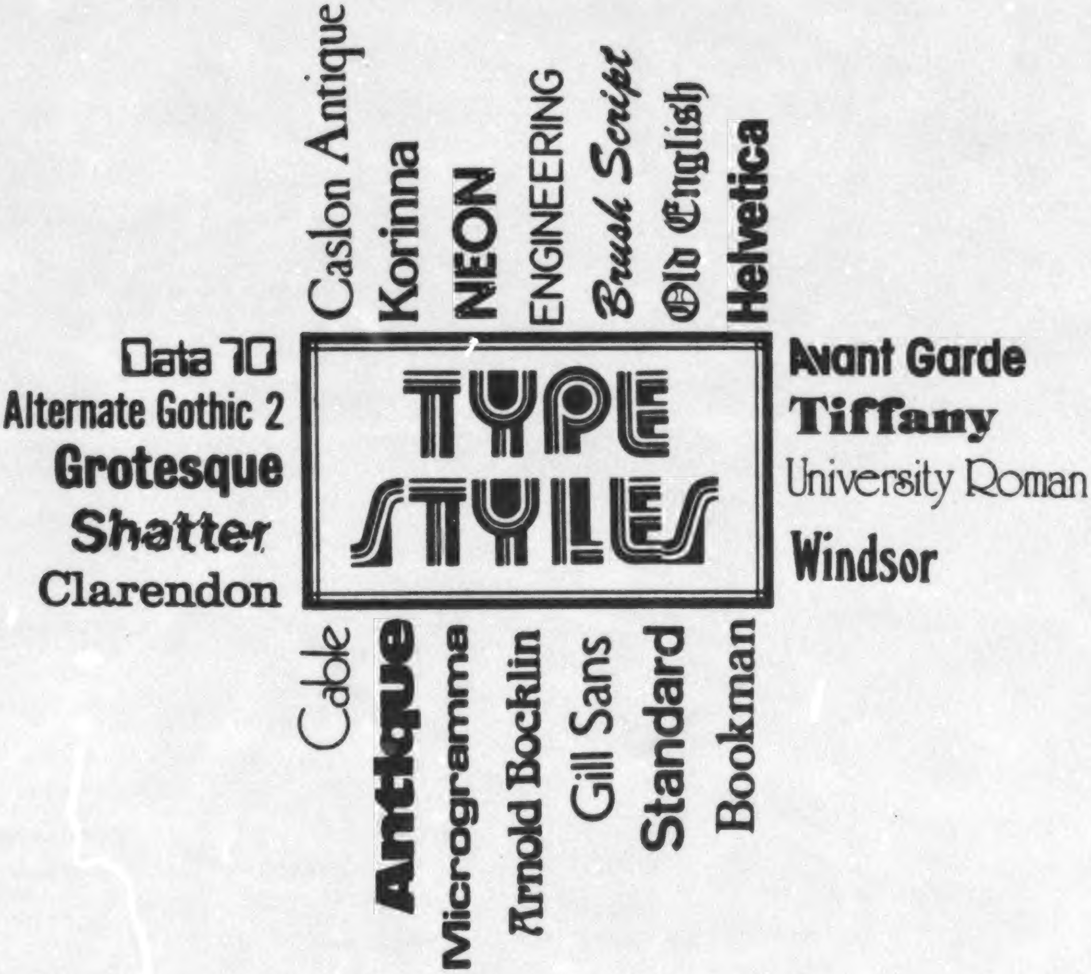
This is an example of justified text material which is also called straight material. This is an example of justified text material which is also called straight material. This is an example of justified text material which is also called straight material. This is an example of justified text material which is also called straight material.

Tabular Material

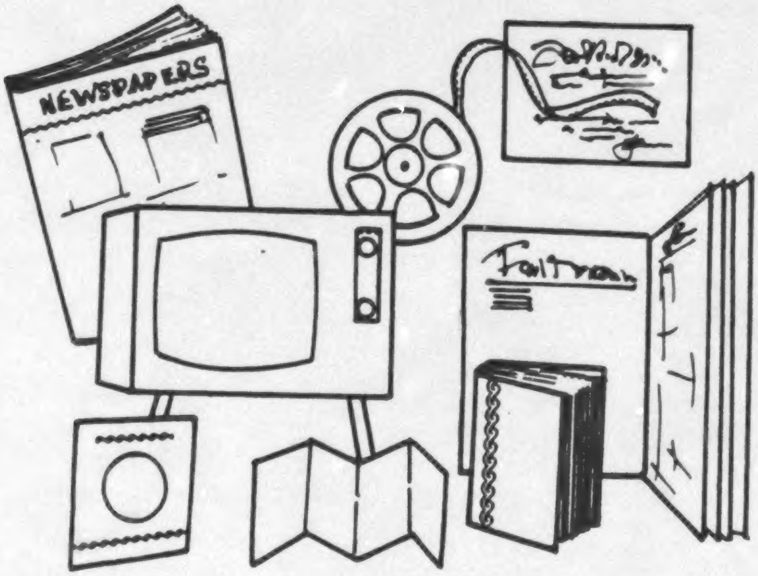
City	**Temp**
Boston	**50°**
Chicago	**40°**
Los Angeles	**80°**
New York	**55°**
San Juan	**85°**
Seattle	**70°**

This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. This is an example of a run-around text. this is an example of a run-around text. This is an example of a run-around text.

This type of layout can be done with an IBM Composer

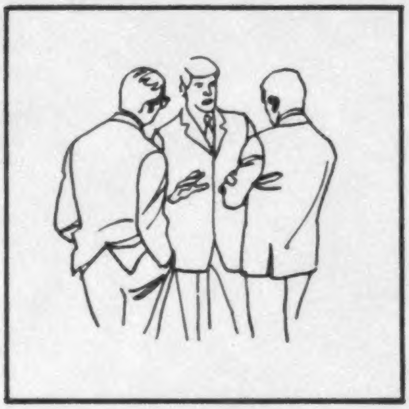
TYPE STYLES
Caslon Antique
Korinna
NEON
ENGINEERING
Brush Script
Old English
Helvetica
Data 70
Alternate Gothic 2
Grotesque
Shatter
Clarendon
Avant Garde
Tiffany
University Roman
Windsor
Cable
Antique
Microgramma
Arnold Bocklin
Gill Sans
Standard
Bookman

TYPOGRAPHY
examples

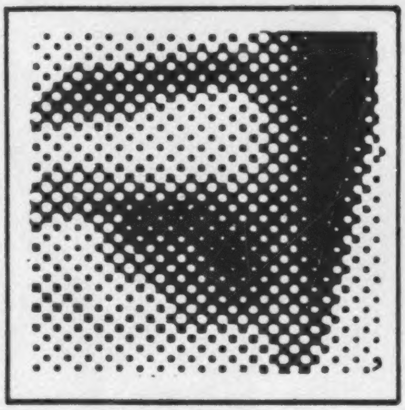

NEWSPAPERS

- **Newspapers**
- **Film**
- **Magazines**
- **Billboards**
- **Road signs**
- **Television**
- **Books**
- **Packaging**

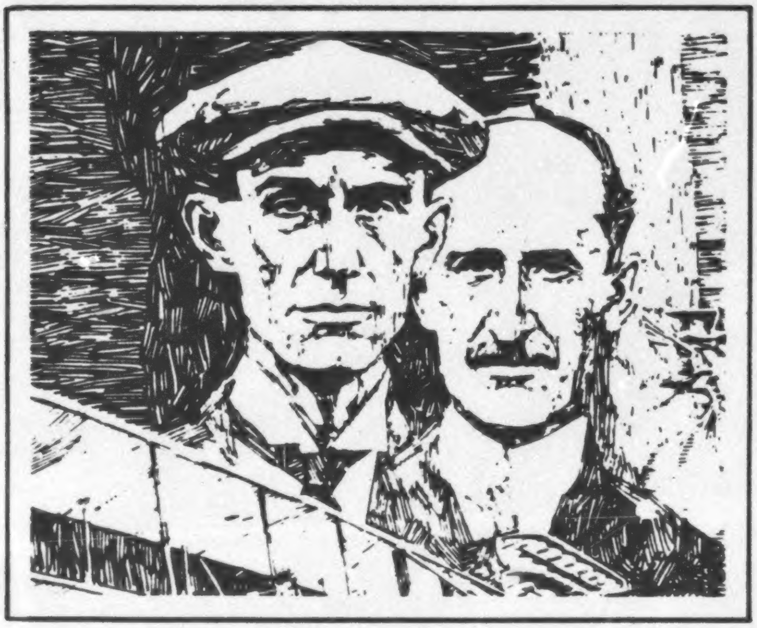
TYPES OF ARTWORK



Line drawing

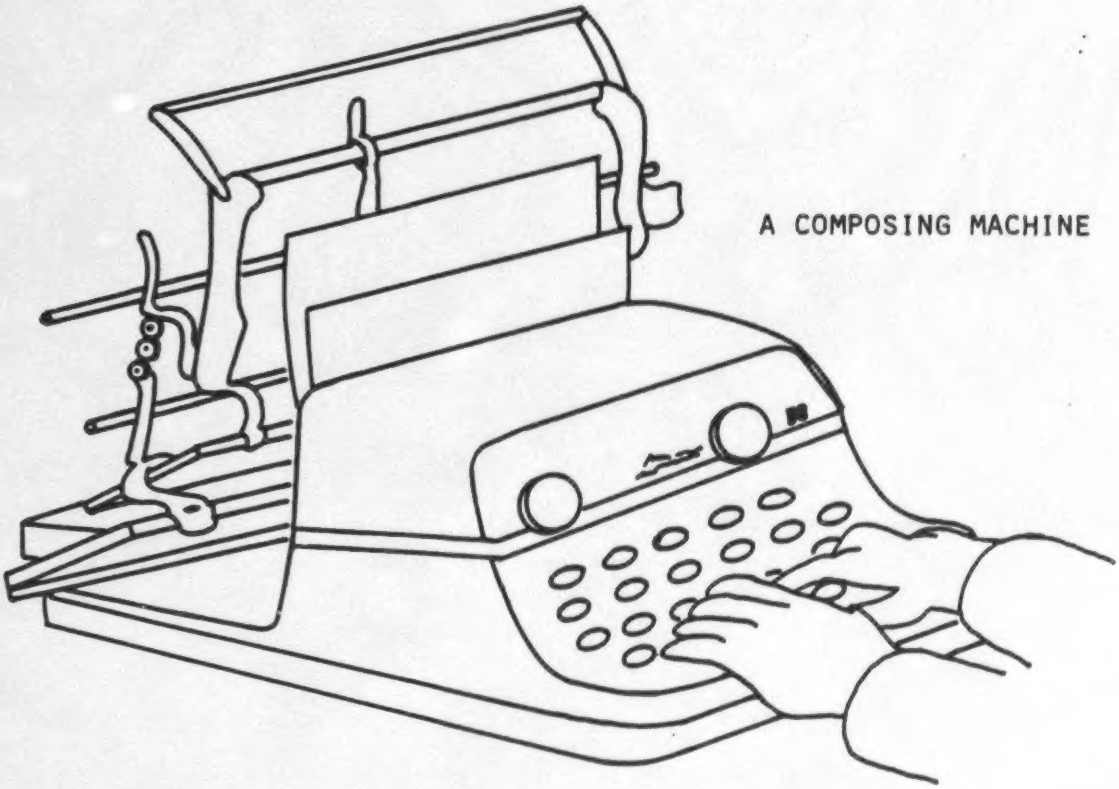


Halftone



Pen and ink drawing

HOT TYPE



A COMPOSING MACHINE